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COMMUNITY REACTIONS TO AIR FORCE NOISE

PART I. BASIC CONCEPTS AND PRELIMINARY METHODOLOGY

PAUL N. BORSKY

**NATIONAL OPINION RESEARCH CENTER
UNIVERSITY OF CHICAGO**

MARCH 1961

CONTRACT No. AF 33(616)-2624

**BIOMEDICAL LABORATORY
AEROSPACE MEDICAL LABORATORY
WRIGHT AIR DEVELOPMENT DIVISION
AIR RESEARCH AND DEVELOPMENT COMMAND
UNITED STATES AIR FORCE
WRIGHT-PATTERSON AIR FORCE BASE, OHIO**

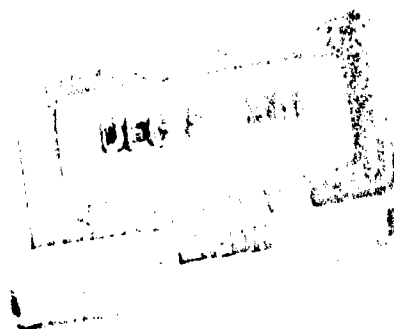
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MARCH 1961

**CONTRACT No. AF 33(616)-2624
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AEROSPACE MEDICAL LABORATORY
WRIGHT AIR DEVELOPMENT DIVISION
AIR RESEARCH AND DEVELOPMENT COMMAND
UNITED STATES AIR FORCE
WRIGHT-PATTERSON AIR FORCE BASE, OHIO**

FOREWORD

This report was prepared by Paul Borsky, Study Director for the National Opinion Research Center (NORC), University of Chicago, under the direction of Clyde W. Hart. The report, Part I of two parts, covers the development of a questionnaire method to assess the responses of community residents to the noise of aircraft operations. The work was accomplished during 1954 and 1955 under Contract AF 33(616)-2624 in support of Project No. 7210, "Human Response to Vibratory Energy," Task No. 71701, "Nonauditory Effects of Intense Sound on Man." Captain R. G. Hansen, USAF, served as contract monitor for the Bio-Acoustics Branch, Aero Medical Laboratory*, Wright Air Development Center, * Wright-Patterson Air Force Base, Ohio.

The detailed research was conducted by David E. Ryan and Richard L. Blumenthal, Assistant Study Directors at NORC, and Dr. Kenneth N. Stevens of Bolt, Beranek and Newman, Inc. Valuable advice and assistance was given by Dr. H. O. Parrack and Dr. Henning E. von Gierke of the Bio-Acoustics Branch.

The studies reported in Parts I and II of the present report formed the basis for Air Force operational procedures to assess community reaction to air base operations and to guide further research in this area. Many publications and procedures published in the meantime have made use of the information contained in this report; a limited number of copies of this report was distributed to interested Government agencies on request. The research data contained in this report originally were planned to be a part of a more complete evaluation of the overall problem and would have presented more definite results. In the meantime, Air Force research activity in this area was de-emphasized. However, many requests for these data were received and it was decided to publish this report at this date without further modification. It should be kept in mind that the manuscript was written by the authors nearly four years ago and that general research activity in this area has continued through this period. Although the data presented are considered valid and valuable, the reader is reminded that they do not constitute the latest or final results in this complex research area.

Air Force publications connected with or growing out of the work reported here include the following:

1. Stevens, K. N., Pietrasanta, A. C., and the Staff of Bolt Beranek and Newman, Inc., "Procedures for Estimating Noise Exposure and Resulting Community Reaction from Air Base Operations," WADC Technical Note 57-10, April 1957.
2. Clark, W. E., "Noise from Aircraft Operations," Bolt Beranek and Newman, Inc. To be published as WADD Technical Report, 1961.
3. Pietrasanta, A. C., and the Staff of Bolt Beranek and Newman, Inc., "Field Measurement of Community Noise Exposure Near Hanscom Field," WADC Technical Note 58-163, August 1958.
4. Clark, W. E., Pietrasanta, A. C., and the Staff of Bolt Beranek and Newman, Inc., "Intrusion of Aircraft Noise into Communities Near Two USAF Bases," WADC Technical Note 58-213, July 1958.

* Redesignated Biomedical Laboratory, Aerospace Medical Laboratory, Wright Air Development Division

ABSTRACT

A comprehensive conceptual scheme to describe the annoyance and complaint processes involved in community reactions to jet aircraft noise and related operations has been developed. This broad theoretical framework is based on a more detailed evaluation of a NACA* study, a series of intensive personal interviews with New York City and Hanscom Air Force Base residents, and discussions with technical personnel concerned with acoustics, public relations, jet manufacturing, and flight operations. The theoretical scheme deals with broad aspects of the problem: the objective physical characteristics of jet stimuli and related residential disturbances, the intervening sociopsychological variables affecting individual perception, feelings of annoyance, the additional interacting factors modifying individual expression of such feelings, and the overall community considerations determining the scope of community action. A standard personal interview questionnaire has also been developed and pretested for possible use in validating the conceptual scheme and in deriving precise statistical relationships among the many variables.

PUBLICATION REVIEW

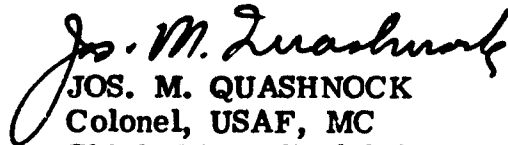

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I. INTRODUCTION

For the past three years the National Opinion Research Center has been engaged in the study of human reactions to aircraft noise and flight operations. Following the series of tragic accidents at Newark, N.J., and Jamaica, L.I., in early 1952, the National Advisory Committee for Aeronautics asked NORC to develop a research plan for determining the nature and extent of human annoyance with airplanes flying overhead and for establishing the relationships of the acoustical and socio-psychological factors which tend to intensify or reduce such annoyance.

After a brief pilot study in the New York and Chicago Airport Areas which indicated that the personal interview technique was a feasible method for determining neighborhood reactions to the aircraft stimulus, a full-scale study of eight major commercial airports was completed. This study, involving 3635 interviews in 180 different neighborhoods, was concerned primarily with reactions to air carrier propeller driven airplanes. While this initial study provided valuable evidence on the effects of airplane noise on people living in the vicinity of airports, it also suggested a number of questions requiring additional research. 1/

Since jet airplanes are expected to replace most propeller planes in the next few years, it was recognized that further research on airplane noise problems should concern itself primarily with jet operations. The U.S. Air Force, which is represented on the NACA research committee, indicated that it was very much concerned with research on jet aircraft since it was the sole operator of jet aircraft in the U.S., and since some of its bases were already experiencing complaints from nearby communities. It was decided, therefore, to transfer sponsorship of community aspects of airplane noise research to the U.S. Air Force.

When NORC was asked to recommend the next step in the research program, it suggested that a broad exploratory study be initiated. Full field studies are expensive and time consuming and before embarking on a definitive research program on jet noise and operations problems, it was felt that additional experimental work should be done to sharpen the conceptual understanding of the annoyance process and to develop further research tools and procedures. More specifically, it was suggested that a selected panel of respondents who had indicated atypical reactions on the NACA questionnaire be reinterviewed intensively to probe for a better understanding of the dynamic factors affecting their responses. It was also proposed that new respondents be selected who were primarily exposed to jet airplane operations, since it was believed that jet noise experiences might present some entirely different research problems. Paralleling these experimental studies of the human aspects of the problem, it was suggested that detailed investigations be made of the acoustical and operational aspects of

1/ Some of the findings of the NACA study will be summarized in sections of this report. The detailed report "Community Aspects of Aircraft Annoyance" may be obtained from the National Aeronautics and Space Administration.

the aircraft complex to determine which physical parameters appeared to be most significant in distinguishing different aircraft experiences. After analyzing the findings of these exploratory interviews, it was suggested that an integrated conceptual framework be developed to describe the annoyance and adaptation processes. The final step in this initial phase of the research would be the development and pretesting of a personal interview questionnaire embodying the various hypotheses included in the conceptual scheme. This questionnaire could then be used in the next phase of the research program to establish the quantitative relationships of various socio-psychological and physical factors affecting the annoyance process.

One point should be emphasized. The exploratory intensive interview is largely unstructured and is designed to encourage the respondent to reveal his views with a minimum of direction and a maximum of spontaneity. Since it does not contain responses to a uniform set of questions it is extremely difficult to quantify its findings. It is not designed to obtain statistically reliable data but, rather to gather a wide range of ideas and hypotheses for more systematic future research. It follows, therefore, that the testing of the hypotheses, and the establishment of quantitative relationships between the various physical and socio-psychological factors are not objectives of this phase of the exploratory research. The final objective of this phase is to develop the questionnaire, the analytical tool, which can be used in a future large scale study. Such a future study can lead to the preparation of an analytical matrix with numerical values attached to the different variables which can be used for planning purposes to approximate average human responses to known variations in aircraft acoustical and other stimuli. But this ultimate objective or even the more limited goal of ranking statistically the hierarchy of physical and socio-psychological factors contributing to annoyance and adaptation are not within the scope of this report.

After negotiation with the appropriate Air Force officials, the above proposals were accepted and the results of the exploratory research will be reported below. The report will briefly describe the chronology of activities during the past year, and then, will discuss in detail the findings bearing on a number of substantive research problems.

II. FINDINGS

A. Chronology of Activities

1. The first phase involved the further analysis of interview data obtained from the NACA study. A detailed statement, "Major Gaps in Knowledge of the Effects of Airplane Noise on Man," was prepared and served as guide in the planning of future research.

2. Since two of the eight airport areas which were included in the NACA study, St. Louis and Minneapolis, happened to have some jet planes operating at the time of the survey (about 10% of total operations), a special analysis was made of all voluntary mentions by respondents of jet aircraft. This analysis suggested a number of qualitative aspects of the jet noise experiments which were further explored in the intensive interviews.

3. Other special tabulations were prepared from the NACA data and evaluated before the approach to further studies was formulated:

- a. Perception, Annoyance and Activities Reported as Affected by Aircraft and Traffic Noises
- b. Variability of Overall Annoyance Responses Among Sampling Areas

4. The firm of Bolt, Beranek and Newman, Inc. were asked to explore the acoustic and other physical aspects of the Aircraft stimulus. After analyzing the problem, the firm agreed to pretest its procedures for measuring selected parameters of the stimulus and to determine the expected variability of normal stimulus exposures. Their report is included as Appendix II of this report.

5. Discussions were held with Air Force officials at Wright-Patterson Air Force Base and at Mitchell Air Force Base, to establish as much information as possible about jet operations and experiences with complaints from local residents.

6. Discussions were held with operating officials of Grumman and Republic Aircraft plants on Long Island and after a detailed study of operating conditions, it was decided to select the first respondents for intensive interviewing in communities adjacent to the Republic plant at Farmingdale, L.I. About a dozen such respondents were initially interviewed. Complaint files and public relations files at the Republic plant were also evaluated

7. The following types of respondents who had previously been interviewed during the NACA study were selected for re-interview at the LaGuardia and Idlewild Airport neighborhoods:

- a. Respondents in close areas who were "not bothered".
- b. Respondents in close areas who were "greatly bothered".
- c. Respondents in distant areas who were "greatly bothered".

Considerable difficulty was encountered in locating and arranging interviews with these respondents. Some had moved, others were not at home when the interviewers called, and since callbacks are expensive and time consuming, only 25 of these interviews were actually obtained. Other factors which influenced our decision not to push this phase of the research were the likely interviewer effects and problems of recall and the absence of jet planes in these areas.

8. After the New York and Farmingdale interviews (which ranged from 2 to 4 hours in length) were analyzed, a tentative analytical outline and Question Guide were prepared for future intensive interviewing.

9. After a series of discussions with Air Force officials, it was decided to select the Hanscom Air Force Base at Bedford, Mass., as a second area for intensive interviewing. Flight paths and operations were analyzed and about 40 respondents were selected in the Lexington, Bedford, Concord and Lincoln areas. The complaint files at the Hanscom Base as well as newspaper files and other historical records of minutes of meetings concerning the expansion of the base, etc., were reviewed. Special interviews were also arranged with a panel of "community leaders" in the above four towns. Included were town selectmen, chiefs of police, newspaper editors, members of town planning boards, a local postmaster and the chairman of a local Chamber of Commerce. These special interviews were analyzed to establish a picture of the community structure and of the attitudes of these leaders toward the local air base.

10. The intensive interviews obtained at Hanscom Base were analyzed and after a series of discussions with Air Force officials, a revised conceptual outline and the first draft of a structured questionnaire were prepared.

11. The first draft of the questionnaire was pre-tested at the Hanscom Air Force Base area, and was found to run about 2-1/2 hours in length. After a series of revisions, eliminating certain sections and clarifying others, a revised second draft was prepared.

12. The second draft was pre-tested at Farmingdale, L.I., and after further revisions, the interview was estimated to run from an hour to an hour and a half in length.

13. After further discussions with Air Force officials and with members of subcommittee Z24-X-20 of the American Standards Association on Community Noise Problems, a final draft of the questionnaire was prepared and is included as Appendix I of this report.

14. Since the West Coast aircraft manufacturers had the most complete records of community complaints about jet aircraft noise and operations, a special study was made of their experiences.

B. Major Problems Considered in Exploratory Research

1. General Framework of Community Aspects of Aircraft Operations

Since one of the underlying objectives of this exploratory research is to sharpen the conceptual understanding of the annoyance and complaint processes involving jet noise and related operations, a large number of potentially relevant hypotheses were explored. Before presenting detailed findings with respect to any particular hypothesis, however, it might be helpful if the overall conceptual framework were briefly described. It should be clearly recognized that human reactions to jet noise and flight operations are extremely complex and that there are numerous unique aspects to every individual experience. Consequently, in attempting to synthesize many different individual experiences and to establish broad generalizations, some details are necessarily oversimplified. With this caution in mind, Figure 1 is presented below as a suggested schematic outline of the factors affecting community aspects of the aircraft problem.

As the network of arrows on Figure 1 indicates, each set of factors is interrelated in a complicated pattern to other physical and psychological conditions. Although it is recognized that in a real experience these factors tend to operate simultaneously and that it is impossible to isolate distinct phases of the annoyance and complaint processes, it is nevertheless convenient for analytical purposes to consider separately the following eight conceptual phases of the problem:

- a) The objective characteristics of environmental problems
- b) The spatial and sociological relationships of individual residents in a single neighborhood and of adjacent neighborhoods
- c) The intervening socio-psychological factors affecting individual feelings of annoyance
- d) The range of actual individual feelings of annoyance
- e) The intervening socio-psychological factors affecting individual expression of annoyance and forms of action
- f) The range of actual expression and forms of action
- g) The intervening factors affecting community action
- h) The forms of community action

The first phase of the aircraft problem logically involves an analysis of the characteristics of the stimulus situation itself. In order to ascertain whether there are any statistical relationships between variations in the stimulus and in the human perception, feelings, and expression of those feelings about the stimulus, it is important to establish some objective measurements of the

stimulus which are independent of the subjective reports obtained from respondents. The subjective respondent reports can then be related to the measured variations in the aircraft stimulus and any statistical relationship between the two can be established.

For example, in evaluating a jet problem or stimulus at a given place and time it is possible to measure objectively certain acoustic parameters of the noise such as the sound spectrum, the peak sound pressure levels in various octave bands, and the duration of those SPL's. From actual flight and operations records, it can be further ascertained how often and how regularly these noises are propagated, and how present activity compares with past trends and expected future trends. It is also possible to estimate the range and average altitude of planes flying over a particular house or neighborhood, and the extent to which it is directly overhead or off to a side (slant-distance of plane). The objective relationships of the jet noise to other environmental noises can also be obtained by similar methods. These objective physical aspects of the aircraft stimulus will vary from house to house and from neighborhood to neighborhood. In order to determine whether there is a statistical relationship between these variations in the objective jet stimulus and the human response to it, these objective characteristics must first be determined. To the extent that some specific relationships can be established, it may be possible for operations officials to manipulate the character of jet operations in order to minimize the disturbance.

Since the jet noise stimulus seldom occurs as an isolated environmental experience but is usually part of a larger complex of problems involved in residential living, it is not enough merely to measure the characteristics of the jet disturbance. It is also important to establish the total context of residential problems in any neighborhood or community. As will be seen in a more detailed discussion in a subsequent section, the presence of other serious non-jet problems can frequently mask the jet problem. Some of the more important residential problems are listed in the schematic outline but there are undoubtedly others which could also be listed. The reversible arrows connecting airplane and non-airplane problems indicate the probable complex interactions of these factors.

The second phase of the schematic outline attempts to show the spatial and sociological composition of a community in relation to the physical characteristics of the stimuli. Each neighborhood has a definite physical structure in which different homes in that neighborhood and consequently the individual residents in those homes are exposed to different intensities of the stimulus. Some homes are closer to the airport and flight paths and receive the most intense stimulation; others are farther off to the side or farther away and experience less intense stimulation. "Individuals I, O, and N" comprise "Neighborhood I." The rest of a given community consists of other neighborhoods in varying spatial relationships to the stimuli. These are designated as "Neighborhoods II and N."

In addition to the spatial composition of a neighborhood or a community, there are the social interactions of individuals and groups of individuals in different neighborhoods. By social interactions we mean the indirect stimulation produced by communication of various individuals or groups of individuals in the community. For example, let us assume that Individual "O" in Neighborhood "I" receives the most intense stimulation and that Individual "N", the least. Through

sympathetic discussion, however, it is possible that the "feelings" of Individual "N" can be affected by discussion with Individual "O", and vice versa. Likewise, the social relationships among neighborhoods can affect "feelings" of Individuals in different parts of the community. It is important to recognize that different Individuals and Neighborhoods actually experience the stimulus differently in terms of direct exposure and indirect social exposure.

It is also obvious that each Individual has different demographic characteristics which may affect his perception and "feelings" about the stimulus. In analyzing individual "response" patterns, therefore, such personal factors as age, sex, education, income, occupation, family relationships and group associations should be considered.

Assuming that two or more individuals with similar demographic factors are found to be exposed to comparable jet stimuli, is there any indication that their "feelings" about jets will be similar? Our findings indicate that a host of other intervening socio-psychological variables must also be considered. These variables are described as Phase Three of our scheme. While it is impossible to list all of the possible socio-psychological factors which may affect an individual's "feelings", it is believed that the key factors are included in Figure 1. For the sake of simplicity only the factors affecting Individual "O" are charted for Phase Three-Six of Figure 1. It should be understood, however, that comparable schemes can be drawn for each Individual and that each Individual has a possible interaction with every other Individual, as is shown in Phase Two.

The first important psychological consideration which is listed is the subjective perception of jet and non-jet problems involved in living in a given neighborhood and community. In Phase One the independent objective character of the stimulus was emphasized. This was considered important as a means of verifying subjective reports of the stimulus. As subsequent discussion will indicate, the possible subjective distortions of perception are also extremely important in understanding the annoyance process. The way an individual subjectively perceives the stimulus will often determine the intensity of his feelings about it. It is crucial, therefore, to determine the subjective perception of jets in terms comparable to the seven items listed under "Objective Characteristics of Problems". Similarly, it is essential to find out the subjective perception of all other problems involved in living in an area in order to establish the overall context in which jet disturbances exist.

The second group of intervening psychological variables involves actual related personal experiences with the stimulus. As far as airplanes are concerned, it includes results of actual exposure to planes flying over the individual's house or neighborhood as well as general contacts with flying in an airplane as a passenger. Both of these types of experiences can influence feelings of fear of crashes and interference with essential living functions such as sleep, rest, reading, speech, listening to radio and TV, etc. These direct personal experiences as well as the indirect experiences of other members of the family and neighbors constitute the heart of the perceived disturbance, since reports of annoyance are generally in terms of these items.

Other possible personal experiences which may affect present feelings about jet planes and other problems include the types of other residential areas and job experiences to which the individual has been exposed. If he has previously learned

to accept various related physical disturbances in other neighborhoods or on his job, it may color his appraisal of his present neighborhood problems. The precise relationships of such related previous experiences are unknown, but they should be considered in evaluating the present "feelings" of a particular individual.

A third group of intervening psychological factors are related to the overall feelings about living in a residential area. Every individual has more or less structured ideas about the kind of neighborhood in which he would like to live. In most instances, however, practical considerations require some compromise with these ideal standards. Consequently, in addition to determining the ideal values, it is important to learn about the actual expectations of advantages and disadvantages before moving to the neighborhood. The extent to which the present realities of living in a neighborhood are in conflict with either the ideals or the expectations of living conditions in the area is undoubtedly an important psychological consideration affecting feelings of annoyance. For example, if an individual prefers and expects to find peace and quiet in a residential neighborhood, and then is unexpectedly faced with the intense noise and threat of low flying planes, his resentment and annoyance are likely to be greater than if he generally likes the noise of urban activity and he knew about the planes before he decided to move into the neighborhood. Likewise, the net balance of advantages over disadvantages and the availability of better alternative neighborhoods are important considerations. In this regard, if an individual has already made specific arrangements to move away from the neighborhood in the near future, his tolerance of a local disturbance is likely to be greater than the person who expects to remain in the area indefinitely.

The interaction of all of the above variables, such as the perception of the jet stimulus in relation to other problems of living in the area, the extent to which direct and indirect experiences with jets have seriously interfered with various living conditions, the degree of previous exposures and adjustments to other related physical disturbances in other neighborhoods or jobs, and the conflict between desired, expected and actual living conditions are believed to be some of the primary psychological variables affecting feelings of annoyance.

Phase Four of the scheme lists a range in such feelings. The five items are not intended to indicate an actual scale of differentiated feelings, but rather to suggest the broad groups of intensities ranging from very intense bother to never bother.

It is important to note that there are reversible arrows connecting the "Range in Feelings of Annoyance" and Phase Five -- "The Intervening Socio-Psychological Factors Affecting Individual Expressions of Annoyance and Forms of Action". This indicates an important finding: that not only does the intensity of feelings of annoyance affect the way in which these feelings are expressed, but that intervening psychological factors which may inhibit or encourage individual expression also may interact on the actual verbalization of the feelings themselves. For example, if a person feels compelled to accept a given disturbance because he feels that there is no possibility of improving the disturbance, that complaints are useless and that he must remain in the area for other reasons, not only will such a person generally refrain from voicing a complaint, but he might even try to suppress his feelings of annoyance by denying any intense bother. This point will be discussed further in a subsequent section.

Assuming a given intensity of feeling of annoyance, not all individuals would be expected to express themselves the same way. In addition to the obvious demographic variables of age, sex, education, income, etc., there are at least five groups of socio-psychological variables which may influence individual variations. These are grouped under the Fifth Phase of the schematic diagram. It can not be emphasized too strongly that a given form of expression or absence of expression is no simple indication of the intensity of feeling or absence of feeling of annoyance. Intervening between simple feelings and forms of expression are the important variables which will now be discussed.

The first obvious condition facilitating expression of feelings involves the knowledge of the appropriate authorities who are in charge of regulating airplane operations. Unless one knows to whom complaints can be directed the most intense feelings may remain unexpressed.

The second group of considerations concern the positive aspects of jet operations. Just as the overall feeling about living in an area involves net balances of advantages and disadvantages, the overall decision to complain or not to complain often involves evaluations of the relative contributions in relation to the disturbances by the offending source. In this regard, the general importance of the airplane facility to the individual as a source of income, convenience or general protection is significant. Likewise, the perceived importance to friends or neighbors or to the larger community is relevant. If a facility is performing an important function and the disturbance is a by-product of the activity, there may be some reluctance to complain and possibly jeopardize the important function. On the other hand, it isn't always sufficient to feel merely that the operation is essential, it is also necessary to believe that the facility has to remain at its present site. Although there may be agreement as to the general value of the facility, if a person feels it could be moved elsewhere to an alternative site where there would be less disturbance, there generally would be less reluctance to complain. Perhaps it should be mentioned again, that these psychological factors may not affect all groups of people uniformly, and that the interaction of the intensity of the airplane stimulus undoubtedly accounts for much of the variation. In summary, the positive aspects of the jet operation and the probable effects of complaints on the continued operation of the facility are important considerations.

Probably the most important group of factors inhibiting or encouraging expression of annoyance involve the feelings about the avoidability of the disturbance. If a person feels that it is physically possible to reduce the disturbance, then he is more likely to urge the adoption of remedial measures. On the other hand, if he feels that given the best intentions, nothing can be done by the authorities to reduce the annoying situation, he is more likely to feel that complaining is a waste of time.

Assuming that a person feels that remedial measures are technically possible, there is still the further consideration as to whether it is socially possible to secure the adoption of such measures. A person generally has to feel that his complaint may be of some value in securing relief from the disturbance in order for him to go to the trouble of even expressing himself. Of course, these hypotheses do not apply to the crank or chronic complainer who enjoys the very act of complaining. The present discussion concerns most people whose complaints are based on actual disturbances.

There are several factors which can contribute to the belief in the social possibility of success. A primary consideration is usually the belief that other residents in the community are equally annoyed and that a complaint would be socially approved. In addition, a person has to have confidence in his own ability to express himself adequately and in the effectiveness of neighborhood or community groups to bring sufficient pressure on the authorities to effect a change. Underlying this last factor is the belief that the authorities are willing to listen and can be persuaded to adopt reasonable remedial measures.

Of course, past experiences with similar neighborhood and community problems will influence one's faith in the possibilities of successful group action. A series of unsuccessful efforts will generally tend to discourage expression while previous successes will usually stimulate new efforts. The extent of neighborhood and community organization and the ease of various forms of expression, naturally, also contribute to the readiness to complain. For example, it is generally easier to get a neighbor to sign a petition than it is to get him to write a lengthy letter or to visit the officials personally. Again it must be emphasized that all of the above factors interact with one another and that the net positive or negative balance results in the expression or suppression of feelings of annoyance.

The ten forms of expression and individual action listed on Figure 1 are not intended to be all inclusive, but are presented as the most typical types of action reported in our research. All of the items are self-explanatory with the possible exception of the last. The "spontaneous expression of complaint in response to direct stimulation" involves a person actually verbalizing some expression of annoyance as the plane passes overhead or as the noise interferes with some activity. The person may be alone or in the presence of others and the spontaneous expression involves a release mechanism for the person's feelings.

The first six phases of Figure 1 have described the stimulus and the individual neighborhood reactions to it. The last two phases of the schematic presentation concern the factors affecting the larger community. A more detailed discussion of neighborhood and community differences will be presented in subsequent sections of the report. For purposes of this summary section, however, we may define a neighborhood as a geographic cluster of blocks or contiguous individual properties, and a local community as the smallest unit of political authority, including a number of neighborhoods, which can take some legislative or administrative action concerning the jet problem.

In the previous discussion of the relationship of individuals and neighborhoods, it was stated that different individuals and neighborhoods are differentially exposed to the jet stimulus. Some persons and neighborhoods are more intensely affected than other neighborhoods located in more distant areas. It is reasonable to expect, therefore, that feelings of annoyance might also vary from neighborhood to neighborhood. The process whereby the community as a whole concerns itself with the jet disturbance is reflected in the six items listed under Phase Seven of the schematic diagram.

The process of relating neighborhood annoyance of jets to community action is not a universal one but varies from community to community in accordance with local custom and practices in dealing with neighborhood problems. Some of the broader generalizations, however, are listed on the diagram. The first consideration is

the universality of the problem. Are many neighborhoods affected or only a few? If the problem is widespread in the community, it is generally easier to secure community wide action. On the other hand, even if relatively few neighborhoods are directly involved, the social and political importance of the affected neighborhoods must be considered. If the residents in the complaining neighborhoods are leaders of the community or have ready access to the leaders, the chances of securing community action are enhanced.

The second important consideration involves the structure of the community and the ease of individual and neighborhood expression. If the accepted procedures for the solution of neighborhood problems are clearly established and understood, and if the mechanism is relatively simple, the chances of securing community action are further increased. For example, in many New England towns, the town meeting is the customary forum for securing legislative redress. Likewise, in most of these communities, there are established civic groups which concern themselves with local environmental problems. These local groups are readily available to residents of different neighborhoods and are expected to furnish leadership and organizational know-how in the solution of these problems. Under such direct and simple forms of local government, it is relatively easy for residents in particular neighborhoods to organize themselves, to appear at a town meeting where each resident has an equal vote, and to secure community-wide support for their neighborhood problems. On the other hand, where communities are large and less well integrated and the forms of government are more complicated and indirect, and the process of securing support from numerous less affected neighborhoods involves a huge organizational effort, the chances of securing community-wide action are reduced unless the problem is fairly universal.

A third factor involves the relative importance of the jet problem in relation to other problems facing the community as a whole. If the officials are preoccupied with other pressing affairs, the chances of securing concerted action on the jet situation are generally less.

Previous experiences of neighborhoods in securing community-wide support for similar problems are also important. If there is an established tradition of community-wide action on such problems, it is generally easier to secure current community-wide support. On the other hand, if similar efforts by the same or other neighborhoods have failed in the past, it might discourage the presently affected neighborhoods from pressing for community action. This item may be considered similar to one discussed under individual action viz -- "The belief in the social possibility of successful action." While this factor influences the neighborhood in its willingness to appeal for community support, it also influences community leaders in their deliberation. If these leaders have tried to secure remedial action in the past and have failed, they may feel it is useless to continue the effort. Correspondingly, if they previously succeeded in securing some improvement, they might be encouraged to press their efforts further.

A final important factor influencing community action involves the possible indirect personal benefits that community leaders may hope to derive from championing the issue. These benefits might merely involve the expected additional political support derived from the publicity of leading such a campaign, or it

could involve more personal benefits. In some cases, some of the leaders may own property in the vicinity of the airport, and by pressing for changes in jet operations may hope for financial and other personal benefits. These considerations are usually difficult to establish but, nevertheless, can be very important.

The final phase of the schematic diagram indicates the particular forms of possible community action. It is largely self-explanatory and ranges from court suits and local legislation restricting the operations of the facility to legislative inquiries and forums discussing the problem.

In the above discussion many statements were made with regard to the factors influencing the annoyance and complaint processes. While some effort was made to indicate the logical basis for including each of the factors, no real effort was made to present any of the specific findings of our exploratory research. The succeeding sections will discuss selected features of the schematic outline in greater detail.

2. Relationship of Human Responses to Variations in the Airplane Stimulus

Is knowledge of the characteristics of the airplane noise stimulus essential or helpful to an understanding of human perception, annoyance or activities affected by the airplanes? Or are human responses more general and not directly related to variations in the physical stimulus? If perception and annoyance are closely related to changes in the airplane stimulus, then precise knowledge of the stimulus characteristics will reduce the error of estimate of corresponding perceptual and annoyance responses. Likewise, in order to compare one airport area with another, or for planning purposes to estimate human responses to a hypothetical aircraft situation, it would be essential to have knowledge of the airplane noise and operations complex. If, on the other hand, human responses are not closely related to the airplane stimulus, then a generalized cross-section analysis of a neighborhood or community with regard to other socio-psychological variables would be sufficient.

The findings of the NACA study shed some light on this problem as far as propeller and traffic noises are concerned. Our pretest experiences also reveal some qualitative evidence on jet noises which will be presented below.

As the NACA data show, if the specific Aircraft Sampled Noise Level (SNL) is disregarded, as would be the case in a cross-section community analysis, then the findings indicate that an average of 58% might be expected to voluntarily mention the presence of aircraft noise, and about a third report that it bothered or annoyed in some way. If the variations in actual Aircraft SNL's among the different neighborhoods are considered, however, the average estimate is seen to produce a wide range of error. For example, when the Aircraft SNL is only 50-60 db, only 15% mention airplane noise in contrast with the over-all average of 58%, and only 8% report any bother or annoyance in comparison with the over-all average of 33%. Likewise, when the Aircraft SNL is at the relatively high level of 79+db, over 90% mention the noise and almost 70% are bothered by it. Table I below summarizes the direct relationship between reported perception and annoyance and the actual level of Aircraft SNL.

TABLE I

RELATIONSHIP BETWEEN REPORTED PERCEPTION AND ANNOYANCE
WITH AIRPLANE NOISE AND THE AIRCRAFT SNL

	All Respondents	Aircraft SNL				
		50-60 db	61-65 db	66-72 db	73-78 db	79+ db
Mention Airplane Noise	58%	15%	27%	43%	58%	90%
Report noise bothers or annoys..	33	8	16	28	40	69
Bothers hearing radio or TV...	12	3	6	10	14	28
Bothers conversation.....	8	1	3	7	8	23
Bothers sleep or rest.....	11	2	3	9	14	27
Frightens respondent.....	9	2	3	8	14	15

It is quite apparent that an over-all average response which disregards the specific airplane noise conditions to which respondents are exposed, is a poor measure of human response. If one community were exposed to only 50-60 db and another to 79+ db and this wide difference in airplane stimulus were ignored, the variation in reported annoyance of from 8% to 69% would be hard to explain from an analysis of socio-psychological factors alone. In fact, one might be tempted to conclude that "human behavior is unpredictable." But if the variations in stimulus conditions are considered, the range of annoyance responses are considerably reduced. It follows that if important socio-psychological factors are also inter-related with the physical changes in stimulus conditions, then the estimated annoyance response would become even more accurate.

Evaluation of the NACA data (Section II 4.3.b. Page 3) gave some insight as to the variability among the 180 NACA sample areas of over-all annoyance with airplanes in relation to differences in Aircraft SNL. In 8 out of 10 areas with Aircraft SNL's of 79+ db, the percent of all respondents who were judged "greatly bothered" was 50% or more. This level of annoyance response was only 12% less than the average for all respondents living in areas with an exposure of 79+ db. To put it another way, if the mean value of 62% "greatly bothered" was used in 8 out of 10 areas in which the Aircraft SNL was 79+ db, the actual annoyance level would have been no lower than 50%. In only 3 out of 100 cases was the "greatly bothered" response ever as low as 30%.

At the other end of the Aircraft SNL continuum, 50-60 db, in 19 of 20 cases, the percent "greatly bothered" was at most 9% above the mean value of 6% who were "greatly bothered". Contrast this small error of estimate with the over-all average of about 34% "greatly bothered" in all of the 180 neighborhoods studied.

Because of the relatively few intensive and pretest interviews obtained in areas where jets are used, and because no effort was made to get accurate acoustic measurements in these areas, it is not possible to state the statistical variations in annoyance responses to jet aircraft. It is reasonable to assume, however, that the variation will be no greater than the NACA data indicate for propeller planes and it is even possible that it will be less. Our qualitative analysis indicates that annoyance with jet noise is comparatively greater than with propeller noise in the close areas. The major reason is probably the higher SNL's of jet aircraft. In any event, this greater annoyance could reduce the range of responses for the close areas. In the distant areas (10-12 miles from end of runway), the higher altitude of jet aircraft may further reduce the average degree of annoyance and also narrow the range of responses.

Additional indications of the differential annoyance responses to jet aircraft were revealed by studying the tabulation of the NACA data. In Minneapolis and St. Louis where 10% of the air traffic consisted of jet flights, from 51-57% of those respondents voluntarily mentioning jets were "greatly annoyed", while only 30% of those not mentioning jets were equally bothered. Further analysis also indicates that the greater annoyance of respondents mentioning jets is not due to difference in over-all Aircraft SNL's. For every different Aircraft SNL, the respondents who mention jets are always more annoyed than those not mentioning jets.

The foregoing analysis clearly indicates that perception and annoyance are directly related to the aircraft stimulus and that consideration of variations in the stimulus greatly reduces the range of reported annoyance.

3. Importance of Different Parameters of the Airplane Stimulus

In the previous section, only one aspect of the airplane stimulus was considered, the peak SNL that was exceeded in only 25% of the observations. This single figure was selected in the NACA study as the most important single index of the airplane complex but it was recognized that a number of other parameters of the airplane stimulus were probably important. In this exploratory phase, the firm of Bolt Beranek and Newman, Inc., was specifically asked to explore the feasibility of measuring some of these other aspects of the noise complex, and some of their findings as well as qualitative data reflected in the interview materials will be presented here.

a. Variability of Sound Spectra

The sound spectrum of the propeller plane differs from the spectrum of the jet in that the higher frequency components are more important in jet noise spectra. Although there are some differences from one jet plane to another, as shown in Table II, there are characteristic differences between most jet planes and propeller planes which are readily recognized by respondents. When asked, "Do you know if there are different kinds of planes flying over, or do they all seem to be pretty much the same?", virtually all respondents could distinguish between jets and propeller planes. When asked, "How would you describe the noise -- what does it sound like?", respondents answered, "The jet sounds like a dull blast on a horn, an unpleasant vibration sensation," "Jets have a different sound to the motors and greater speed," "Well the jets fly the fastest, and the bombers (B-29's) don't fly so fast, but they make a lot of noise too," "You hear them longer; the

jets fly so fast, you hear them and they're gone," "Jets are a wicked noise, an awful racket," "You get a tremendous roar so that you think the house will shake down," "Occasionally they make so much noise on a Sunday when they come whooping down; they sound off a bit," "If it's high enough you can feel by the sound. If it is flying low you can tell ahead of time. That is when you get a frightened feeling," "The propeller planes don't bother at all. They're quieter I suppose, and not as frightening. The jets go so fast and sound so loud; they're more dangerous."

Although most people can recognize a jet from a propeller plane, very few indicated that the character of the sound was in itself a cause for greater annoyance. Perhaps the right questions weren't asked, or perhaps the other objectionable features of the noise, high peak level, speed of passage and connotations of fear, etc., completely masked feelings about the "quality" of the sound. Respondents were asked, "What is it about the noise that bothers you? . . . In what way does it bother you?" "What do you usually think of when you hear the noise?" "Aside from the loudness and other things we've been talking about, is there anything about any of these jet noises that is unpleasant or disagreeable?" These questions and modifications of them generally failed to elicit any specific mention of the "quality" of the jet noise.

TABLE II

ESTIMATED SOUND PRESSURE LEVELS

AT 250 KNOTS AND 400 FT.

db re 0.0002 dyne/cm²

	Power Level	Frequency Band -- Cycles Per Second		
		75 - 150	300 - 600	1200 - 2400
F89C	With After Burner	107	116	110
F89C	100%	99	110	106
B57	100%	102	110	104
F86	100%	102	105	101
F86	80%	90	92	92
F84F	100%	94	101	100

b. Variability of Peak Levels and Durations of Peak

As indicated in the previous section, the NACA data reflected the peak SNL's exceeded by only 25% of the observations. In this study BB&N was asked

to formulate a more precise description of the noise complex. Peak level can be defined in any number of ways. Peak point is readily ascertainable from an actual tape recording of the passage of a plane. Peak level was arbitrarily defined as the peak sound pressure level within the 300 - 600 CPS band. The length of time that the sound pressure level is within 10 db of the peak level is defined as the duration of the peak. Peak level and duration are principally a function of the power level of the engine, of the distance from the plane to the observer, of the speed of the plane, of atmospheric and terrain effects on attenuation, and of the altitude above sea level of the ground.

Since the usual take off procedure for a jet, as Table III shows, is to maintain a fairly low altitude until a speed of about 300 knots is achieved and then to climb very rapidly at about 1500-2000 feet per mile, the effects of jets on peak levels and durations is quite different from propeller airplanes. At areas from 2 to 3 miles from the beginning of a runway, the average altitudes on jet take-offs ranges between 270-520 feet. The peak SPL in the 300-600 CPS band reaches 118-124 db (F-89C with AB) and the duration of peak is only a fraction of a second. At 4 to 5 miles, the average altitude increases to 800-1600 feet. The peak level is reduced to 110-114 db, but the duration is increased to 4 to 7 seconds. At eight miles, the average altitude jumps to 5600 feet, the peak level is reduced to about 86 db and the duration is 25 seconds.

TABLE III

SELECTED AIRCRAFT DATA ESTIMATED FOR AN F-89C JET

TAKING OFF WITH AFTER BURNERS

Distance from Beginning of Runway (miles)	Altitude Range (feet)	Range in Peak SPL 300-600 CPS Band (decibels)	Duration of Peak SPL (seconds)	Duration of SIL of 70 db (seconds)
1	0-100	---	---	---
1-1/2	50-280	119 - 134	1	7
2	150-400	116 - 124	2	8
3	320-780	109 - 118	3	10
4	500-1700	102 - 114	4	12
5	700-3100	95 - 110	7	17
6	1300-4400	90 - 104	13	20
7	2600-5800	86 - 97	20	18
8	4000-7200	82 - 91	25	10

Of even more importance than peak level, perhaps is the "activity" interference level. For example, other experimental studies have shown that at a Speech Interference Level (SIL) of 70 db, reliable conversation is barely possible in a very loud voice at a distance of 2 feet. ^{1/} For the F-89C, as Table III shows, the duration of speech interference at 2-3 miles is 10 seconds; at 4-5 miles, it increases to 17 seconds; and for the distant areas, it barely exceeds the SIL of 70 db by 10 seconds. Although the actual frequency bands in the SIL are weighted differently from the computation of peak levels and are not strictly comparable, communication is one of the key activities which jets disturb and, therefore, the SIL comparisons may be more meaningful as daytime measures of jet noise intensity.

c. Variability by Type of Aircraft Operation

In the NACA study, an effort was made to study take-off, landing and circling or cruising operations. Due to a number of factors these operations were hopelessly intermixed at the close areas and the reduction in engine power on landing approaches was largely offset by lower altitudes so that the estimated SNL differences were not too great. In jet operations, landings and take-offs are believed to result in larger differences in Peak Levels, in Speech Interference Levels and in the duration of these levels.

The best information available indicates that jet planes on landing approaches seldom cross populated areas below 1500 feet altitude with more than 80 percent of full power. This means that, for close areas 3 miles from the beginning of a runway, peak SNL's for take-off operations should exceed landing operations by about 24 db. Even at the areas 5 miles distant, the difference in peak SNL's should be about 12 db.

Another possible difference between jet landing and take-off operations is the more pronounced whine of the jet turbines on landing operations. This difference was not noted in our pretest interviews, but the possibility of this distinction should not be ignored.

d. Variability of Different Types of Airplanes

In the NACA study, it was recognized that a DC-3 made less noise than a DC-6B or a super-constellation. By the careful selection of major commercial airports, however, it was hoped that the differences in the noise complex among the eight airports would not be great. Besides, the differences due to pilot techniques and atmospheric effects were believed to be greater than the variations due to the size of airplanes.

In the case of jet operations, however, the differences in peak level between older smaller aircraft and newer larger planes is estimated to range up to 22 db. Obviously such large differences must be controlled in any future study. A T-33 is probably the quietest jet plane in the USAF. An F-84F is about 2 db greater

^{1/} Rosenblith, W.A., and K.N. Stevens, Handbook of Acoustic Noise Control, Vol. II, Noise and Man, WADC Technical Report 52-204, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio, June 1953.

than a T-33 (at 400 feet altitude and 250 knots). An F-89C with after burners is about 15 db greater than an F-84-F and an F-101 with after burners is about the noisiest, at present, and is about 5 db greater than the F-89C, or 22 db greater than the T-33.

e. Variability Due to Altitude of Air Base and Atmospheric Conditions

At sea level a plane can usually gain altitude faster and, therefore, appear less noisy at given distances from the beginning of a runway. In estimating the SPL's at given altitude-distance relationships, the altitude above sea level of the base itself must be considered. In addition, it must be recognized that temperature, wind velocity and other atmospheric conditions can also affect the peak level by as much as 10 db or more. In selecting airports for study, these factors must all be evaluated and equalized.

f. Variability Due to Irregularity of Aircraft Operations

In the NACA study little recognition was given to differences among neighborhoods due to variability over time in aircraft operations. It was recognized, however, that such variations existed. In New York and Chicago, for example, there were flights scheduled around the clock, while at Memphis and Atlanta there were hours when there were no flights and other peak hours when the volume was almost as great as at New York and Chicago.

Theoretically, at least three types of variability over time can be distinguished:

- 1) Seasonal or month to month fluctuations
- 2) Daily changes due to shifts in wind and weather conditions
- 3) Hourly changes due to atmospheric and schedule variations

While the precise consideration of all such variables is difficult in most study designs, awareness of these factors is important. Airport areas should be selected carefully to minimize seasonal and daily fluctuations, and control should be achieved over at least daytime vs. nighttime operations. At some jet bases, round the clock flying is scheduled; at others, only daytime flights are permitted. Such differences would obviously differentially affect sleep interference which is a key factor in annoyance responses.

g. Variability Due to Volume of Aircraft Operations

While the findings of the NACA study were ambiguous with regard to this factor, it cannot be completely overlooked in a study design. The intermixing of flight operations at the close and intermediate areas obscured any clear cut distinctions in the volume of flights, and consequently prevented any precise analysis of this factor. In jet operations, however, flight paths and flight schedules may be more regulated and it may be possible to select neighborhoods with distinctly heavy or light traffic patterns.

h. Variability Due to Changes in Slant-Distance

All else being equal, the closer the airplane is to the respondent,

the louder the noise he will hear. Consequently, the area directly under the flight path will receive the most intense noise exposure. For areas 2-3 miles from the beginning of a runway a restricted zone of only 1000 feet wide can be considered as directly under the flight path. At 4-5 miles, the altitude increases so the width of the zone also increases to about 2000 feet in diameter. At 7-8 miles, the width of the relatively homogeneous acoustic zone is estimated to be about a mile.

Because of attenuation of sound, all neighborhoods outside these limited zones receive less intensive noise exposures. It is possible, therefore, by selecting a neighborhood 2-3 miles from the beginning of a runway but off the flight path (the plane is at an oblique slant relationship to the respondent), to establish a slant-distance to the plane which is equal to the altitude of the plane directly overhead at 4-5 miles or at 7-8 miles. Theoretically, the peak sound levels and SIL levels can be equated in such different on path and off path neighborhoods, with only the angle or slant relationship differing. Since fear appears to be a crucial element in psychological responses, a person off the path should be less fearful of crashes than someone directly under the flight path, and perhaps less bothered by the same peak noise level or SIL.

In the NACA study, the mixture of circling operations also obscured on path and off path relationships. It is hoped, however, that purer jet operating conditions may be found to test this hypothesis.

i. Variability in Aircraft Emergence NL

Since aircraft noise is only one of the possible noises included in a particular noise environment, it is important to consider the total noise complex in an area. In the NACA study, neighborhoods with quiet and noisy ambient backgrounds were selected under equal aircraft noise conditions. While the findings were inconclusive, there was a tendency for annoyance to be greater when the difference between the Aircraft SNL and Background SNL was greater (greater emergence of aircraft noise). One of the practical difficulties was to find sufficiently noisy ambient levels in purely suburban residential areas which were close to airports. In any event, any analysis scheme must recognize such differences in emergence of the aircraft stimulus as a possible source of variation in psychological response.

j. Variability in Trends of Aircraft Operations

The final aspect of the physical stimulus which will be discussed here involves the changes over time in the level and volume of aircraft activity to which a particular neighborhood is exposed. It may be important to distinguish areas in which a larger number of noisier airplanes have recently been introduced, or in which the schedule of operations has shifted from day to night, from areas in which the amount or character of the noise has recently been reduced. With larger numbers of more powerful airplanes constantly being introduced, it may be that the psychological annoyance response is partly a function of the trend in the character of the noise stimulus. This hypothesis will be discussed at greater length in the next section.

4. Importance of Socio-Psychological Factors in Determining Perception and Feelings of Annoyance

The previous discussion considered the problems of separating and measuring in some objective manner the physical aspects of the aircraft noise source. For analytical purposes, as has already been discussed in the summary section, it is of prime importance to secure an independent control over the external stimulus factors, so that in comparing different psychological responses in different neighborhoods one can be certain that the response variations are not simply due to differences in the environmental situations. Once the physical aspects have been equalized by an experimental design, then the interplay of socio-psychological factors can be examined.

It is important to emphasize that the relative influence of various human factors may not be uniform under all types of aircraft stimulation. It may be that at the intense upper levels of jet noise and frequent flight operations, that the moderating influence of various psychological factors are of little importance. Under certain intermediate stimulus conditions, on the other hand, certain human variables may be largely instrumental in securing tolerance and acceptance of unpleasant environmental conditions. Likewise, under lower, less intense noise conditions, it may be that very few personal activities such as speech, communication, sleep, rest, relaxation and feelings of personal security are actually disturbed and, consequently, the significance of certain psychological forces may be minimal.

If the tolerance or acceptance levels are found to be differentially affected by various intervening human factors in accordance with ascertainable ranges of stimulus conditions, then the implications for aircraft operations and planning are obvious. Under the most intense noise conditions, people would not be expected to adapt themselves to the intruding stimulus; and under other intermediate ranges, it would be possible to institute certain policies and practices to minimize the disturbance and to maximize neighborhood acceptance of the noise source.

The determination of the actual existence of such differential effects, the statistical derivation of the cut-off points and the establishment of relative weights to the hierarchy of socio-psychological adaptive factors, however, is not within the scope of this exploratory study. Available evidence supporting such hypotheses and some of the technical problems of measuring these factors, however, will be presented below. Nine major topics will be discussed:

- a. Structure of Feelings of Overall Annoyance
- b. Importance of Perception of Noise Source
- c. Importance of Activities Affected
- d. The Effects of Fear on Adaptation
- e. The Effects of Inter-personal Relations
- f. Importance of Expectation of Character of Residential Area
- g. Importance of Attitudes toward the Missions of the Air Base
- h. Importance of Feeling that the Aircraft Disturbance is Unavoidable
- i. Importance of Personal Variables

a. Structure of Feelings of Over-all Annoyance

In the NACA study, a three-point scale of feelings of over-all annoyance was established, and an effort was made to analyze the various components of annoyance. A number of technical problems, however, prevented a more systematic evaluation of the structure of over-all annoyance. Since it was the first full field study of this problem, inadequate knowledge of the detailed factors contributing to annoyance dictated the use of open, non-directive questions. This technique as has been mentioned before, permits a maximum of spontaneous comment and the reporting of whatever salient factors appear to be important to the respondents. It also reduces the uniformity of stimulation by identical questions, however, and complicates the establishment of intensity or substantive rating scales.

For example, as Table I shows, when all respondents in the NACA study were asked, "What kinds of noise do you usually hear around here?", only 58% spontaneously mentioned airplane noise. Since only those persons voluntarily mentioning airplanes were even asked, "Does the airplane noise ever bother or annoy you in any way?", 42% of all respondents were never asked this question. Likewise, since 57% of those mentioning airplane noise said they were bothered by it, only one out of every three respondents was even asked, "In what way does it bother or annoy you?" For two thirds of the interviews no systematic data were collected on the question of the structure of annoyance with airplane noise.

Another weakness of the NACA interviews which complicated the development of substantive and intensity type scales was the recording of apparently inconsistent responses in answer to specific questions. This factor was not uniform at all Aircraft SNL's as Table IV below shows:

TABLE IV

DETAILED OVER-ALL ANNOYANCE GROUPS BY AIRCRAFT SNL

<u>Over-all Annoyance</u>	<u>Aircraft SNL</u>				
	<u>50-60db</u>	<u>61-66db</u>	<u>67-72db</u>	<u>73-78db</u>	<u>79+db</u>
Never bothered.	59%	37%	26%	9%	8%
Used to it now.	4	5	7	6	4
Bother some - qualified	20	25	24	26	17
Bother some - unqualified	10	15	10	9	7
Bother some - border line to Great Bother	1	-	2	2	2
Bother a great deal - border line to Some Bother	-	1	1	2	2
Bother a great deal - qualified	2	8	11	18	20
Bother a great deal - unqualified	4	9	19	28	40
	100%	100%	100%	100%	100%
Number of interviews.	650	481	1048	725	731

Over a third of all persons living under 79+db gave qualified and sometimes inconsistent responses. Of these, 17% sometimes said the airplane noise didn't bother or annoy and 20% who were generally greatly bothered indicated a lesser degree of annoyance in some answers. In contrast, only 22% of all respondents living under Aircraft SNL conditions of 50-60 db gave any contradictory answers, of which 20% indicated no bother and only 2% who were generally seriously bothered gave less intensive responses.

Additional knowledge gained during the exploratory work of the past year indicates that most of these conflicting responses can probably be overcome by careful planning. An analysis of the intensive interviews indicates that one of the major reasons for apparently contradictory responses is the presence of ambivalent feelings and a fear that one's answers are not giving a balanced picture of these feelings. For example, if other neighborhood problems are considered very important, persistent questioning about airplane noise may result in a conscious effort by the respondent to minimize his feelings about the noise problem in order to stress the other problems. Likewise, if the respondent feels that the missions of jets are connected with important national defense efforts or that the manufacture and maintenance of airplanes involves the livelihood of many friends and neighbors, he may be reluctant to give answers which indicate intense feelings of bother or annoyance. He may be fearful that a strong negative response will be interpreted as too hostile to the group's interest. Some illustrative responses follow:

"I'd rather they didn't (fly low). . .it wouldn't hurt if they weren't going so low over the house. . .It's the safety rather than the noise. I do feel it is a necessity that they are over there. They are an asset but they fly so low. . . that's why I say you can't do without them; it's a necessary evil," "When you consider they are all planes for defense, you just keep your mouth shut and be glad they are there," "Myself, I could complain, but with the world situation being what it is, it's just as well for those fellows to have a place to train," "I don't like them, but I can't see complaining about it," "They (jet run up) blast until 10:30 to 11 at night and they really sound like they're going to explode right in your living room. They're trying to do something about that, they say. It was in the local paper -- an article. It's a terrific sound, of course, but it's better than the enemy or destruction. It's a small inconvenience and you don't notice it because they're accomplishing something," "You don't go around saying, 'Did you hear the planes last night?' I'm not the one to go look for arguments. I have no grudge on airplanes. I wouldn't concentrate on them too much. After all it means a living for all my neighbors you know."

During the intensive interviewing the following approach was found effective in reducing such apprehensions and in achieving the proper perspective of ambivalent responses. First, sufficient time was given at the very beginning of the interview for the respondent to spontaneously discuss all kinds of problems about living in his neighborhood. A discussion of 10-15 minutes is generally sufficient to satisfy the respondent that a balanced picture has been given and it also furnishes the study with the necessary general context of aircraft noise in relation to other environmental problems of the neighborhood. This approach also effectively masks the major objective of the study, aircraft noise, by indicating that our interests are general, involving all aspects of living in the area. Once the respondent's suspicions about the purposes of the survey are allayed, it has been found that he is generally more willing to reveal critical comments as well as favorable ones. If, on the other hand, the respondent is ambivalent in his feelings about airplanes and the discussion plunges into the details of airplane

noise, before he has had an opportunity to express his feelings about the pros and cons of the airplane situation or other important problems, experience indicates that he often becomes very suspicious and that frankness and rapport deteriorate rapidly.

A second approach is to anticipate the existence of ambivalent feelings and to begin each phase of the interview with some open questions which will afford an opportunity for these feelings to be expressed. Then, when subsequent specific questions probe about responses to the detailed aspects of a problem, the answers tend to be more direct and less qualified. A further advantage to this method is that every respondent is systematically questioned about key aspects of the airplane noise source and that, as a consequence, statistical treatment of the various factors is facilitated.

Questions 1-6, of Appendix I are indicative of the open questions discussed above and Questions 9-11 are illustrative of the systematic probing for feelings about airplane noise. It will be noted that not only are responses to airplane noise included, but that parallel treatment is afforded to other noise sources spontaneously reported in the neighborhood. This not only masks our interest in airplanes but also provides valuable data on comparative responses to other noise conditions.

b. Importance of Perception of Noise Source

The acoustic engineers can record the airplane noise on a sound meter or recorder and as has been shown, it is important to know the objective stimulus characteristics. In order to understand individual differences in annoyance under equal stimulus conditions, however, it is essential to know the way in which a person perceives the noise source, whether or not his view agrees with the meter readings. In the course of re-interviewing "Non-annoyed" respondents living close to the airport, responses indicated that they did not feel that airplanes were very loud, low flying or a threat to their security. For example, one person said, "They don't fly so low; you can't touch them." Another said, "They don't fly right overhead they fly over that house (pointing two houses away -- about 150 feet.)". The fact that if any plane going by should crash, it would objectively have affected the respondent as well as his neighbors is not important in understanding the atypical feelings of these respondents. That the respondents did not see the planes as too close or as a threat to them is the important psychological consideration.

The NACA findings offer further evidence on the possible distortions of perception. As Table V indicates, "greatly bothered" persons more often report that airplanes fly by very often. Although the objective conditions were equalized in the study design, three times as many "greatly bothered" as "non bothered" said the airplanes fly by "very often".

TABLE V
PERCEPTION OF FREQUENCY OF FLIGHT

Respondent Says Airplanes Fly Over:	Overall Annoyance		
	No Bother	Some Bother	Great Bother
Very often	21%	32%	59%
Fairly often	34	41	31
Occasionally	45	27	10
Number of interviews	1148	1237	1250

When asked, "When the planes do pass here, do they ever fly very low?", 91% of the "greatly annoyed" said yes, while only 31% of the "non-annoyed" gave this answer. As Table VI shows, under every kind of airplane noise situation, the "greatly annoyed" more often perceive the airplanes as flying very low. It is interesting to note that 90% of the atypical "greatly annoyed" living 10-12 miles distant from the airport said planes fly low over their homes, while only 20% of the "non-annoyed" living in these same neighborhoods gave this answer.

TABLE VI
PERCENT SAYING PLANES FLY VERY LOW

Aircraft SNL	Daytime Emergent NL	Volume of Air Traffic	Overall Annoyance		
			No Bother	Some Bother	Great Bother
50-60 db	-18 db	High	24%	37%	82%
	"	Low	20	48	83
	18-29 db	High	39	47	71
	"	Low	14	56	100
61-66 db	-18 db	High	19	42	80
	"	Low	15	41	86
	18-29 db	Both	27	46	91
67-72 db	-18 db	Both	30	70	73
	18-29	Both	35	65	92
	30+ db	Both	41	63	90
73+ db	-29 db	Both	42	67	92
73-78 db	30+ db	Both	45	69	94
79+ db	30+ db	Both	57	67	92
All interviews regardless of airplane situation			31%	60%	91%

The administrative implications of perceptual distortions have already been recognized by a number of air base commanders. While it is probably true that airplanes have to fly fairly low over the neighborhoods which are close to the airport, a public demonstration of actual take-off and landing procedures has been found effective in correcting some of the perceptual distortions which respondents had. The effects of such public relations programs on persons living in more distant areas may be even greater, since it can be objectively shown that jets are usually quite high in these neighborhoods.

c. Importance of Activities Affected

Table I, which is repeated below, indicates that the most important residential living activities interfered with by airplane noise are hearing radio or TV programs, conversation, and sleep, rest and relaxation. It is significant that the percent of all respondents mentioning such interference increases consistently as the Aircraft SNL increases. This indicates an appropriate relationship to the reality of the stimulus exposure. It is also interesting to note however, that if people report that airplane noise bothers even when the Aircraft SNL is only 50-60 db, the percent who mention interference with hearing radio or TV programs or with sleep and relaxation is almost as great as those respondents under more intense aircraft noise conditions.

Because these activities were reported as voluntary responses to several successive open questions, and as mentioned previously about two-thirds of all respondents weren't even asked these questions, the absolute percentages are probably understated, but the relative difference among SNL groups are probably more valid. In the exploratory interviews, the way in which the noise bothers was intensively probed and the activities mentioned were similar to the items reported above. Of course, it wasn't possible in these selected interviews to establish a statistical hierarchy of importance of these activities, but as Question 10 of Appendix I indicates, a systematic investigation of these factors is possible.

TABLE I

RELATIONSHIP BETWEEN REPORTED PERCEPTION AND ANNOYANCE WITH AIRPLANE NOISE AND THE AIRCRAFT SNL

	All Resp.	Aircraft SNL				
		50 - 60 db	61 - 65 db	66 - 72 db	73 - 78 db	79+ db
Mention Airplane Noise.	58%	15%	27%	43%	58%	90%
Report Noise Bothers or Annoys. 33		8	16	28	40	69
Bothers hearing radio or TV . 12		3	6	10	14	28
Bothers conversation. 8		1	3	7	8	23
Bothers sleep or rest. 11		2	3	9	14	27
Frightens respondent. 9		2	3	8	14	15

In the NACA study, the question also arose as to the importance of the cumulative effects, and "Johnny-come-lately" aspects of aircraft noise in relation to other noise and non-noise disturbances in a neighborhood. In the intensive interviews, an effort was made to ascertain the chronology of annoyance feelings by asking respondents, "Which of the nuisances did you first find out about after moving here?" "Do you remember how you felt about it at first?" "Which of the nuisances did you find out about next?" "Did your feelings about (the first nuisance) change in any way when you found out about the second?", etc.

Responses to these questions indicated a considerable diversity of experiences. Newer residents tend to perceive of many local annoyances practically simultaneously, so that as soon as they moved to their neighborhoods they report awareness of a number of problems. Older residents, on the other hand, have difficulty in recalling the sequence of events, so that little insight can be secured from their answers. A few persons did indicate a cumulative effect of one disturbance piling up on top of another. One "greatly annoyed" respondent who was reinterviewed reported that mosquitoes were the first disturbance and that airplanes followed with the following effects: "Well the mosquitoes (were first). We were here one day and were attacked. I felt I was sold down the river. My daughter was bitten up so badly that she had scars for six months. . . The airplanes (were next). The mosquitoes were minor compared to the airplanes. All you really had to do was to get adequate screens and that would have been enough. With the airplanes all you can do is shoot them down." Another respondent mentioned traffic noise first and then airplanes, and when asked how he felt about the traffic, he answered, "I felt, boy what a place; getting it from both sides at once."

d. The Effects of Fear on Adaptation

As reported in the NACA findings and as summarized in Table VII below, 60% of all "greatly annoyed" voluntarily mentioned their personal fear of airplanes crashing into their homes; another 20% indicated personal fear of flying in an airplane or of having airports close to populated areas. The pervasiveness of connotations of fear being associated with airplane noise is further emphasized by the responses of the deviant group of "greatly annoyed" living in distant areas where planes do not generally fly below 2000 feet. Three-fourths of these respondents indicated a fear of crashes on the first direct question about noise.

TABLE VII

PERCENT OF RESPONDENTS MENTIONING FEAR OF CRASHES

IN ANSWER TO SELECTED KEY QUESTIONS

Content of Questions	Overall Annoyance			
	Some Bother		Great Bother	
	Percent Indicating Fear on Each Question	Cumulative Percent of Unduplicated Respondents	Percent Indicating Fear on Each Question	Cumulative Percent of Unduplicated Respondents
Present dislikes about area .	1%	1%	11%	11%
Noises heard in area -				
kinds of bother.	10	11	33	35
How do you feel about planes?	20	22	49	58
Importance of airplanes . . .	2	23	2	59
Reaction to closing Newark Airport.	4	25	6	60
<u>Subtotal-Direct expressions of fear.</u>		<u>25%</u>		<u>60%</u>
Present attitudes about flying	48	31	53	17
Necessity of having airports near city.	23	38	33	20
<u>Subtotal-Indirect expressions of fear.</u>		<u>38%</u>		<u>20%</u>
<u>Subtotal-Not expressing any fear</u>		<u>37%</u>		<u>20%</u>
<u>Total all respondents</u>		100%		100%
Number of interviews		1237		1250

The NACA report suggested that fear was one of the most important elements distinguishing airplane noise from other noise experiences. It was hypothesized that if a person is fearful of airplane crashes, "time" may intensify feelings of annoyance rather than soothe them. Some people concerned with the airplane problem have been heard to say almost wishfully that many residents objected to the trains and automobiles at first and now have learned to accept them, and that "time" will also solve the airplane problem. Naturally, it is impossible to say with certainty that in the long run, a process of "natural selection" may not result in people who are sensitive to low flying airplanes moving away from airport areas and being

replaced by persons more tolerant of airplanes. Of course, it took fifty years or more for the railroads to overcome strenuous neighborhood opposition, and it may be that in the year 2000, a similar process of adaptation will have occurred as far as airplanes are concerned. During the next 50 years, however, our intensive interviews indicate that where fear exists, annoyance may not lessen with time.

Airplane noise often acts as a trigger mechanism in stimulating fear reactions. When this process occurs, each passage of an airplane represents a potential threat. The noise of an approaching plane sets up a tension system which is only released when the plane safely passes. Viewed from this constant tension-provoking process, "time" and increased volume of exposure may actually intensify the number of fearful experiences and, therefore, increase annoyance with airplane noise. Some of the actual responses obtained during the intensive interviews which suggest such reactions are cited below:

"Well you can't help it. (Pay attention when they are low). How can you help it when they are so low. Suppose something happened to the plane and she hit the building. That would probably mean death to everyone in the house. Do you remember a few years ago when a few transports hit some houses in Newark. My niece wanted me to fly to her wedding but I wouldn't take a chance on getting killed.", "You seldom think of a car going by. With an airplane you can't help it; you have to look. Well we hear the motor boats, but they are pretty good. They don't keep it up late at night. That is a sound when they miss you aren't worried. When they fly over the house, then you take notice.", "If they go any lower, just a couple of inches, they will take the chimney off.", "The only thing that bothers me is the hazard. There's no need for it -- to fly over Manor Section (supposed to be off the flight path).", "In 1906 I moved to 5th Ave. near the elevated in Brooklyn. I couldn't sleep the first few nights because of the elevated going by, but after that it didn't bother me. You can hear them (the airplanes) missing and that is when you get scared." "Well whomever you talk to -- that is the only thing that bothers them. You can never really tell when one of them will drop on you.", (Get used to it?) "I guess so. I believe in that, but no matter how much will power you have, when a plane comes right over your house, it will scare you.", (Get used to it?) "Yes, I would agree to that, in certain ways. But not to that noise and the plane coming down real low. It is the danger that is so worrisome and frightening.", "Eventually you get used to it. You just don't pay too much attention to it. That's how you get used to it. We used to hear the cars when they went by but we don't any more. Now I sleep on this cot and the only thing that wakes me is the jets when they roar overhead.", "Generally, the traffic doesn't bother; just some planes when they come low. A few years ago, they brought in the jets here and, Oh brother! Well they come so low, it gives you the impression that they are coming right through you. I usually put my hands over my head and think, 'Is it really going to crash in?' It's a wicked feeling. . . ."

On the other hand, "time" may sometimes reduce feelings of fear and, thereby, lessen tension. One respondent said, "I'm not as frightened as I was. Well, because so many have gone over and they all pass over the house, that I know they just fly low and will pass over."

Whether fear increases or decreases with time can only be established over the

years with continued research. Present indications which are based, at most, on 6 or 7 years of intense exposure to large commercial transports or jet planes, indicate that fear has increased as the volume of planes and the size and speed of planes have increased. NACA data also indicate that those persons who had lived all their lives in the same neighborhoods, and those who lived in their present area the longest, were more often "greatly bothered" by the airplanes. If "time" alone (6-7 years) were sufficient to produce adaptation, then they would have been "greatly bothered" less often.

e. The Effects of Inter-personal Relations

Since housewives are usually at home during the day and more often exposed to the airplane noise stimulus, it was felt that they might be a major influence on the family's feelings about airplanes. Likewise, the perceived feelings of friends and neighbors were believed to be potentially important. During the intensive interviews each respondent was asked, "Now what about others in your family. . . How does your (husband-wife-children) feel about living around here? Why is that? What does he like? Dislike? . . . How about your neighbors, etc.?"

Practically every respondent reported that other members of his family as well as his neighbors shared his feelings about the airplanes. As in the case of the perceived stimulus, it is not too important whether these other people actually do share the respondent's feelings, but that he considers that others agree with the appropriateness of his reactions.

Since this agreement with one's own reported feelings was so universal, and since there was need to reduce the length of the interview, this battery of questions was eliminated from the final draft of the proposed questionnaire. Reports about neighbors' attitudes are covered in Question 26 of Appendix I in connection with reports about complaint experiences.

f. Importance of Expectation of Character of Residential Area

Practically everyone has some notion of what his ideal residential area would be like. The extent to which the airplane noise source is in conflict with this ideal is, of course, an important psychological variable.

Very little information was gathered on desired ideals for residential living in the NACA study. Information was collected, however, on anticipated likes and dislikes. It was found that very few people are aware of the specific character of a neighborhood when they decide to move there. Their concern is generally directed toward the house itself -- the cost, the layout, the aesthetic appeal. When asked, "How did you happen to pick this neighborhood to live in?" almost 40% indicated that it wasn't a personal decision, that they had no choice or that it was an accident. About 20% mentioned convenience to job or general convenience of the location and only about a third offered specific social or physical advantages of the area. Only one out of every four people who were bothered by the airplanes had any expectations of any disadvantages or annoyances, and only 1% expected trouble from the airplanes. Most of the expected dislikes involved location, facilities, neighbors, congestion, etc.

It has often been said that people should expect noise if they select a house near the airport. The fact is that all evidence indicates that they are not aware of the airplanes until they actually move to the area. Many people inspect the area on a Sunday, when few planes are flying. Others may notice a few planes flying by while they are briefly inspecting a house, but don't realize what the experience will be like on a 24 hour basis.

In the intensive interviews at Bedford and Farmingdale, it became quite apparent that goals and expectations are very important. Most respondents indicated that they had moved to the suburbs to get away from the congestion and hub-bub of the city and the dangers to their children of heavy traffic. They expected the neighborhood (near the airport) to provide quiet, residential open country. Few were even aware of the airport or believed it would be as bad as they now felt it was. The airport at Bedford, for example, has expanded tremendously in the past five years, bringing a heavy influx of population with all of the growing pains of rapid suburban growth. In addition, the expanded base has brought more and noisier jets flying overhead. All of these affects attributed to the airport are in direct conflict with the basic values most people expected to find in their areas. Consequently, it is not surprising that they resent the intrusion of the airplane activity on their nice residential areas. In fact, some of the resentment due to high taxes and congestion which are blamed on the airport expansion may increase the intensity of complaints about airplane noise and low flying. Not that the noise and low flying are not considered important disturbances in themselves, but that it is difficult to complain to the airport authorities about such indirect effects as high taxes and growing congestion of new homes. Consequently, it was sometimes found that a "convenient handle", such as noise or closing of access roads was often used to express the cumulative annoyances with the air base.

As Question 4 of Appendix I indicates, it was also found that an "aided-recall" flash-card technique was helpful in stimulating discussion about specific problems which hadn't previously been spontaneously mentioned. The open questions about likes and dislikes are followed by this flash-card which introduced questions about ideals, expectations, etc.

The net balance of feelings about the area is an indication of the intensity of the conflicts between goals, expectations and the reality of the current situation. It also reflects attitudes about the future of the area. The NACA findings indicated that respondents who were "greatly bothered" with the airplanes generally only reported liking their area "a little", but that few indicated a net negative "dislike" for their areas. A complementary finding was the fact that few were actively planning to move from their area and that most people still had hopes for changing the airplane noise situation.

At the Bedford Airport, the temporary closing of one runway increased the volume of flights over the Lincoln area. Most respondents in Lincoln were informed of this temporary shift and as a short-run situation they were generally willing to accept it. There is ample indication, however, that if the expectation were for an indefinite prolonged exposure, their feelings would have been much more critical.

g. Importance of Attitudes Towards the Missions of the Air Base

In the NACA study, it was found that attitudes toward the commercial airlines were generally positively correlated with tolerance of airplane noise. Persons who reported "no bother" or only "a little bother" more often said the airlines were "very important", while "greatly bothered" more often said they were only "fairly important" or "not important."

In the case of U.S. Air Force operations, indications are that general feelings about "National Defense" and the specific missions of the military airplanes are even more important in securing the acceptance of the airplane disturbances. Whether this psychological factor is equally important under all levels of aircraft noise and operations is not known. That it is important, however, is clearly indicated by the following comments gathered during the intensive interviews: ". . . and if it's essential for defense, we can put up with a slight annoyance. In case of a national emergency, we'd probably be delighted that we had all these planes here for protection.", "They are essential to national defense -- if that was a commercial field, I'd move out of here.", "As far as I know I don't know a great deal about the airport, I think that they are here for the welfare of the vicinity and humanity and as such they are valuable enough so I won't speak any more about it.", "In other words, they are an asset and not a liability.", "One of the complaints was that they had planes there for research, but I don't see anything wrong with that. I also feel that military support is valuable.", "Well, what he (Air Force representative) had to say sounded logical. As I said, there are two sides to it. There is our defense over there."

Feelings that the jets are for defense and that national defense is important to everyone is not always quite enough to produce acceptance of the local noise, etc. Some people feel that the activity does not have to be near their neighborhood; others passively accept it as a military decision beyond their control; and still others welcome the nearby installation. The latter group, of course, are most likely to make an effort to accommodate themselves to the noise situation. Some of the comments indicating these feelings are reported here: "Someone was telling me that they will need more air bases because of the possibility of another war. It's nice to know that they are handy.", "Well, in case of war, they've got to practice somewhere and get their experience.", "Well, I feel that if a defense post is necessary and it seems to be, I would just as soon have it here.", "They can't get much further away and protect the city of Boston."

h. Importance of Feeling that Aircraft Disturbance is Unavoidable

If a person feels that the noise source is important and that it is located nearby for a good reason, but that the particular operations create an unnecessary or avoidable disturbance, then it is likely that the person will feel bothered and annoyed. In understanding this complicated process, it has been found convenient first to ascertain whether a person feels that it is physically possible for anyone to do anything about the noise and aircraft operations. In the NACA study, 69% of the "greatly annoyed" felt that it was physically possible to secure an improvement. In the intensive interviews, feelings about jet noise were somewhat less optimistic. One person said, "Yes, definitely, they could muffle them. Johnson put a good muffler on the motor boat, so they could do the same with

the airplanes." Most respondents, however, agreed with this answer, "Well, I don't suppose they can do much about that. That's something you have to live with if you want to stay here." Further discussion of the influence of feelings of futility on restricting the expression of annoyance feelings will be presented in connection with a discussion of overt complaint behavior.

A second consideration is whether the respondent feels that pilots and officials are sufficiently concerned about his rights and welfare. If he feels they are making a maximum effort to minimize the disturbance, then it is more likely he will make a greater effort to live with the noise. Some comments reflecting these attitudes are reported below:

"Oh yes. . . definitely (concern) I guess they have rules and probably strict ones. . . The military are pretty strict. If a guy pulls a boner more than a couple of times then he isn't going to pull it much more.", "I feel that (concern) is stressed by the military and the civilian authorities. That is why you find the pilots in a lot of ditchings and putting themselves in hazardous conditions.", "Well the pilots have a certain amount of control, but he has to get up to a certain speed and altitude in a limited amount of time and space. I don't go on one cylinder instead of 8 in my car.", "They're supposed to get a certain altitude before they come over.", "Yes, I think so. . . except occasionally there's some reason why they don't -- like the weather or something, but I think they try to be careful. They get called down if they don't -- they investigate.", "Yes, the majority are conscientious."

Sometimes respondents distinguish between the relative skills and maturity of Air Force and commercial pilots. Most respondents feel that both are equally well trained and oriented toward the seriousness of their jobs. A few, however, said that Air Force pilots were young and less responsible. Such comments reported below, of course, heightens feelings of fear and belief that the disturbance is avoidable: "I never gave it much thought. . . they probably would be. . . they (commercial pilots) are a business and some of these fellows are more or less on a joy ride.", "In other words, assume the pilot did make a mistake, or was just horsing around. I don't think any pilot at the base would deliberately come out and buzz the area as far as that goes. But the reason I say if I knew the pilot, in the past when I was doing my hitch in the army, there were some pilots that I wouldn't have step inside of the plane just to have them warm it up.", "The only thing that bothers me is the hazard. There's no need for it -- to fly over here. I'm assuming they are familiar with the ground rules; the tower should notify them."

1. Importance of Personal Variables

Only age and education were found to be significant demographic variables affecting annoyance feelings. The middle aged and better educated were generally more tolerant than the younger and less well educated.

Previous experiences with other noise conditions at work or in other residential neighborhoods did not appear to have much effect on acceptance of intense aircraft noise levels. A person might accept equally intense noise at work because he felt it was an inevitable part of the job, but for residential living,

he wanted different conditions. The primary consideration generally was not other noise experiences, but the necessity, or avoidability of the aircraft noise.

5. Importance of Socio-Psychological Variables in Determining Overt Behavioral Responses

Our discussion so far has been in terms of variations of the physical airplane stimulus and corresponding shifts in human perceptions and feelings about the airplane situation. Most administrators can roughly understand the meaning of changes in sound level readings or the fluctuations in flight operations statistics. These are tangible data recorded on acoustic instruments and operations reports. The measurement of psychological feelings, however, often appears to be too intangible and complicated.

The primary experience of administrators is with reported complaints by individuals or civic groups appealing for the reduction of aircraft noise or the modification of some operating procedure. Their major concern is with the potential threat that such tangible complaints have on the continued operations of their bases. Although many of them don't realize it, their concern is also with the underlying feelings of annoyance which prompt the overt complaints. Whenever complaints are received, the administrator must make a judgment as to the validity of the annoyance expressed in these complaints. He must decide whether the disturbance is real and serious, or whether the complainer is a "chronic griper" exaggerating the situation. He usually also tries to anticipate the seriousness of the first complaints by making a rough judgment of the number of non-complainers who may feel as keenly about the disturbance but have not yet expressed themselves. The advantage of making an accurate estimate of the "complaint potential" before actual complaints snowball into an organized community campaign is quite obvious. Yet, the techniques for making such judgments about the underlying feelings of non-complainers are extremely difficult, and as will be shown in subsequent discussion, the volume of complaints at any given unit of time is often a poor reflection of a community's underlying feelings and "complaint potential".

For years public relations experts have tried to develop "rules of thumb" to relate overt complaints to a corresponding "complaint potential". While a considerable amount of general knowledge and experience has been amassed, the specific judgment is still largely a crude personalized art. It is known, for example, that relatively few people will ever, under any circumstances, express their feelings to the authorities. It is known generally that younger, better educated people in a higher socio-economic status group will more often complain or express themselves. But the specific standards which would provide a more precise clue as to the "expected number" of complaints under a given intensity of feeling are still not available.

It is known that a number of intervening socio-psychological variables often facilitate or discourage the expression of annoyance feelings. The precise statistical relationships of these variables are not yet known, but their general impact will be briefly described below. It should be emphasized that until such numerical relationships are empirically determined it will be very difficult to judge accurately the underlying "complaint potential" from the relatively few overt complaints actually received. It is the complaint potential which constitutes the

maximum scope of the disturbance and contributes to the extent of community interference with base operations.

It is the objective of this research to develop a better understanding of the relationships between actual variations in the aircraft noise source, the "complaint potential" or underlying psychological feelings and the actual overt expression of these feelings in the various forms of complaint. Eventually, it is hoped that an analytical matrix will be developed embodying the empirical numerical relationships of the above parameters so that more accurate judgment may be made of the "complaint potential". At the present time, however, it is our belief that the most reliable method for ascertaining these underlying feelings of annoyance is through personal interviews of a cross section of residents. It is hoped that after enough of such interviews have been analyzed under known variations of the offending noise stimulus that average empirical relationships will be established. These average factors will then provide the basis for anticipating "complaints" and "complaint potentials" and for judging the seriousness of actual community conditions.

It may be more helpful to discuss first the variables which affect expressions of annoyance by individuals then to consider the interpersonal factors which shape a neighborhood and a community's behavior. In the NACA study, personal and neighborhood complaints were studied. In the exploratory phase of this research, some of the broader community factors were also investigated.

a. Some Evidence on the General Incidence of Complaint Behavior

In June, 1946, the National Opinion Research Center asked a national cross section the following question: "Have you ever written a letter to your Congressman or any other government official to give him your views about some public question?" It should be stressed that the question did not concern a response to a single issue at a given moment in time, but a cumulative experience during the lifetime of all adults interviewed. Naturally, the response to a single issue would be much smaller than the cumulative answers given in response to the above question. Only one out of every eight adults reported that they had ever written to officials in the past. As expected, about a third of the college educated, 12% of the high school and only 5% of the grammar school educated reported having written. The rate among men was greater than among women, averaging 15% vs. 12%; and the rate among younger persons under 40 years of age was 14% in comparison with 12% among older adults over 40 years. A regional difference was also found with 18% of New Englanders reporting activity in contrast with only 11% of the Southerners.

It should be recognized that these letters were not all critical; some of them were undoubtedly in support of a policy expressed by a public official. Consequently, it can be seen that the average number of "expected" critical letters one could reasonably anticipate receiving on a single issue would be quite small. If reports of Presidential mail on controversial issues are considered, the number of such letters probably ranges from 3 to 5 per 11,000 adults or only about .03 of 1%.

In the NACA study, about 0.5% of the "moderately annoyed" and 5.0% of the "greatly annoyed" reported that they had ever expressed their feelings to the

authorities by writing, telephoning, signing a petition, or communicating in some other way. These complaint rates compare favorably with the general experience reported above.

b. Factors Influencing Personal Expression of Annoyance

In the NACA study and in the subsequent intensive interviews completed under this exploratory research program a number of factors were found to reduce complaints. Six of the principal variables will be discussed below:

- 1) Lack of knowledge of the proper authorities
- 2) Belief that it is physically impossible to reduce the airplane disturbance
- 3) Belief that complaints will be considered improper by neighbors or the social group
- 4) Belief in personal weakness of expression
- 5) Belief that complaints will be ineffective
- 6) Lack of social organization, leadership and ease of expression.

It should be emphasized that the relationships of these impediments to complaints are unstable and that given an intense feeling of annoyance, the change in any one of these factors can release an increase of individual complaints without any apparent change in the airplane stimulus situation.

1) Lack of Knowledge of the Proper Authorities

In order to make a complaint, it is first necessary to know to whom one can complain. In the NACA study, over 60% of all respondents had completely wrong notions about the proper authorities. Only 16% correctly mentioned the CAA or CAB; the rest mentioned city or county agencies, the airlines or airport operators. At many civil airports, there are no central facilities for registering a complaint; each of the airlines maintains separate facilities. At manufacturing establishments, such as the Republic plant, and at Air Force Bases, this problem of decentralization may not be as serious a consideration. Yet even in the generally well informed Bedford area, there were some people who reported, "You'd call someone at the base." Who that someone was, they didn't know and rather than get the expected run-around if their telephone call were transferred from official to official, they indicated they failed to call.

2) Belief That It Is Physically Impossible to Reduce the Airplane Disturbance.

This factor has already been briefly discussed in connection with its influence on feelings of annoyance. Obviously, if the respondent believes there is nothing that can be done, the telephoning of a complaint would be expected to produce at best commiseration by sympathetic officials but not physical relief. Consequently, under such feelings of futility it might be considered a waste of time to complain. Some people, however, feel so badly about a particularly intense

experience that they will call anyway to get their annoyance off their chests. Others must feel that the effort has even the slightest possibility of success in order to make the effort. Some illustrations of these feelings are cited below:

"Outside of calling once or twice, I never called after the group was formed. I've had the impulse, but just had the feeling it wouldn't do any good. I felt they were aware of the situation and were doing what they could." , "They hold your hand beautifully on the phone." , "I think they're here to stay. I don't think anything can be done. You know these things are going to continue to exist, so rather than fight it, you live with it." , "I guess it has to be done somewhere. I think they just have to. I don't see where else it could be put. They'd have the same problem anywhere else they put it." , "Nothing much can be done about it. It's a government reservation."

Of course, this concept of physical impossibility to do anything is also a very unstable and relative situation. When asked, "Do you think someone may find a solution in the next few years?" most respondents who felt that there was no current solution had unlimited faith that scientists would find a way in a few years. Should they shift their feelings and believe that a new method had been found to reduce the disturbance, the volume of complaints might be expected to increase without any change in the stimulus situation.

3) Belief That Complaints Will Be Considered Improper

If a person feels that he may be considered unpatriotic if he complains, or if he thinks he will lose his friends and alienate his neighbors who may depend on the air base for their livelihoods, he may hesitate to express himself fully. Some examples of these restraints are cited below:

"They are here for the welfare of the vicinity and humanity and as such they are valuable enough so I won't speak any more about it." , "As my husband says it is a good thing that they are ours. We are kind of used to them. At first though they would wake the children and I was irritated by that. I'd rather not have them here, but there is nothing to do about that." , "I suppose the Army thinks it's important so I imagine it's a necessary evil. I have two nephews in the Air Corps so I suppose I can't say much about it." , "If you're up and about not -- but if you're in bed the planes give you a bad time. The cat hides and sometimes runs up on people. But I like to put up with the planes because it's for defense. When they take off (I feel) here comes a friend, a jet. There was a big article in the local paper. It's a choice of Republic or Grumman and their noises, or the enemy. They don't want people to complain. There were some people who wrote to Albany and Washington. If influential people complain, they might move the plants. Only one person (complained around here) because they're anti-social. After all it means a living for all my neighbors, you know."

4) Belief in Personal Weakness of Expression

Some people have a self image of being inarticulate and unable to express themselves capably. For fear they may embarrass themselves if they

called or wrote, they refrain from expressing themselves at all. When asked in the NACA study, "Do you think it's possible that you and your neighbors could help get the authorities to improve the airplane situation?" about 60% said, "No." In the intensive interviews, when asked, "Why?" some of the respondents revealed inferiority feelings such as, "I'm not much of a talker," "I can't convince them," "I'm not the one to be the complainer," "I can't stand up to them and argue."

5) Belief that Complaints will be Ineffective

Even if a person feels capable himself of complaining to the officials, he usually likes to feel that he isn't alone, that the group is behind him and that others will help. He likes to feel that there will be sufficient pressure to be effective. Past experiences of successful groups efforts tend to encourage individual expression, while feelings of isolation, of group weakness or past failures at group action tend to discourage complaints.

In the NACA study, the most frequently mentioned reasons for not complaining were the feelings that authorities wouldn't pay attention or that enough people wouldn't join together in complaint. Of those who did complain, about 2/3 felt it was a waste of effort. Some additional indications of such feelings of futility were obtained in the intensive interviews:

"Little fellows don't count much around here. All the people here signed the petition but it went into the wastebasket like I suppose all the others. Crooked politicians; they all take a little bribe.", "Well if the Government has put so much money into it, they aren't going to pull up stakes because the town wants it.", "They appealed to the State Senator. I know they talked to the officials over at the Bedford Airport. I think that after the meeting things improved a little. They told us that when the new runway is built we won't get the traffic. Meanwhile they go right over the house you know.", "I think they do as good as they possibly can. They've got to have these planes. You can't have them so far out they can't defend the city. If you must accept them you might as well do it graciously. We can't do anything about it anyway.", "Well it's got to be done someplace. They will do what they want to. If we don't get the noise someone else will.", "They have a committee at the airport to meet with the people of the surrounding towns. I suppose you call that public relations and they ended the complaints. I suppose that is as far as it got."

It doesn't have to be repeated that this feeling of social futility is also a very unstable factor. New aggressive leadership can instill the spark of confidence needed to release latent feelings of annoyance. Experiences at Cedarhurst, L.I., Newark, N.J., and elsewhere are ample proof that once local leadership gets behind an anti-noise and low flying campaign, mass support can often be generated.

6) Lack of Social Organization, Leadership and Ease of Expression

This last factor is perhaps one of the most important and is related to feelings of social futility discussed above. Every neighborhood and

community of which it is a part has certain established groups and procedures for handling social problems such as noise control. The way in which an individual of such a community would be expected to think of the problem and to express himself is largely determined by such group mores. For example, at Lincoln, Mass., the town meeting is the established medium of such expression and at a town meeting a warrant (resolution) was passed to establish a committee to reduce the noise and low flying of airplanes. A respondent, then answered that she herself, hadn't called to complain because she felt it was best to give the committee a chance to do its job. If she complained personally, she felt it would be a sign of "no confidence" and interference with the committee's work.

The extent to which a community has a long established tradition, and closely knit system of organizations concerned with problems such as noise control, of course, will influence the ease of personal and group expression. If there are no established groups, with organizational know-how, funds, leadership and a history of past successes on other issues, it will obviously be more difficult for group action to get started. Moreover, if some energetic group does succeed in getting an organized group in motion and calls a meeting or circulates a petition, it is obvious that the volume of complaints will rise without a corresponding increase in the intensity of the stimulus situation. One respondent who reported that she had signed a petition, but had not indicated any personal annoyance was asked why she had signed. She answered, "My neighbors asked me to, and they would have thought me mean if I didn't support them. . ."

c. Problems of Judging Neighborhood and Community Reactions

In the NACA study, the primary sampling unit was a group of adjacent city blocks or a group of houses within a relatively small rural area which was exposed to homogeneous airplane and background noise conditions. Each sampling unit could be considered a part of a different neighborhood, but all 22-24 neighborhoods within the 10 mile radius of the major airport could be considered part of one or more comparable communities. A local community is defined operationally as usually the smallest unit of political authority which includes the neighborhood. In most instances it would be a city, a town or a township. In some cases, it might be a special purpose district, such as a school, water or fire control area. It would be the primary political unit in which members of a neighborhood would normally expect legislative or administrative action concerning noise control problems.

Since different neighborhoods within a community are exposed to different kinds of airplane operations, it would be expected that neighborhoods would differ in their "complaint potentials." Those exposed to more intense noise or low flying would be expected to feel more annoyed than distant neighborhoods off the flight path, over which airplanes never fly low or are seldom even heard. The expression of complaints by individuals in a neighborhood would be a function of the various factors discussed above, especially the knowledge of the authorities, cohesiveness of feelings among neighbors, and the existence of active neighborhood civic or homeowner groups to facilitate group action.

Whether the larger community could be induced by some of its constituent neighborhoods to take the lead in complaint activities depends on still other sets of social variables. No extensive study has been made of these factors since the neighborhood has been the primary unit of past research. During this exploratory phase, however, a start was made at analyzing this still more complicated problem.

At least six important social factors were found to be operative at the Hanscom Airport area:

1) The relationship between the number and importance of the neighborhoods most intensely affected and the community as a whole.

If only a relatively small number of neighborhoods are intensely affected by the jets and the people in these neighborhoods have little prestige or influence on the local governmental organization, then it is generally difficult to obtain the support of official community leadership.

2) The structure of the governmental and non-governmental organizations in the community

The existence of established and influential neighborhood groups and the ease with which they can express themselves or gain access to the governmental authorities is important. In New England, the town meeting is the legislative unit of each community and each resident is entitled to attend, speak and vote on town warrants which can be proposed by any group of residents. Under such a power structure it is relatively easy for residents in selected neighborhoods to "pack" a meeting and secure community sanction for neighborhood programs.

3) The relative pressures of other community problems

If most of the residents of a community are fully occupied with the consideration of other problems which are considered more urgent or more important to the welfare of the community, the noise problem may be temporarily lost in the shuffle.

4) The history of past community action

If the community has attempted to cope with the problem or similar problems in the past and has succeeded in accomplishing something, it is usually an incentive to try again. But if previous efforts were unsuccessful, then the community leadership might hesitate to risk another defeat.

5) Belief in the possibilities of successful action

Whether or not previous efforts were ever made, if the leaders of a community feel that opposing the will of the Air Force or Federal government has little chance of success, they may hesitate even to undertake a campaign against them.

6) Socio-economic differences

The socio-economic character of a neighborhood is, of course, important. If it consists of primarily well-to-do residential areas with high property values and strict street zoning regulations, the impetus to act on a noise control problem might be greater. If, on the other hand, the neighborhoods affected are mixed; industrial, commercial, and less desirable residential areas,

with a host of other physical disturbances besides the airplane problem, the willingness of the community to assume leadership in attempting to restrict airplane activity may be lessened.

The relevance of the above community factors, as well as others which may be uncovered in future research, should be considered in any further investigation of neighborhood reactions. Even if they do not become the object of primary research efforts until a better understanding is achieved of neighborhood responses, the influence of these factors on different neighborhoods should be understood.

d. Problems of Validating Responses

Since administrators of air bases are primarily worried about the net effects of annoyance feelings as expressed in restrictive community action, it is understandable that there is concern about the validity of personal interview reports. This is not a unique problem associated with aircraft noise but applies to all public opinion research. The question is often asked, "How can you be sure that people give you honest answers?" The past 25 years of experience in opinion polling offers ample evidence of a general frankness of response by most respondents. Once general suspicions are overcome and good rapport is established, most people are in a sense flattered that their opinions are important enough to be solicited.

In the case of aircraft noise, several validating checks are built into the proposed questionnaire (Appendix I). First, there is the question of salience and free response. The first six questions of the interview offer no clues as to the purpose of the study. The extent to which airplane noise is spontaneously mentioned is an indication of the true salience and intensity of feeling about the disturbance. Likewise, every major section is introduced by an open question which again measures spontaneity of response. For example, question 9A5 of Appendix I, asks in open fashion, "Could you tell me just how you feel about the () noise -- in what way does it bother you?" before specific probes are asked about fear, sleep, conversation, etc.

Second, there is the question of consistency of response which can be determined from an internal analysis of each pattern of answers. Another aspect of this check is the consistency of answers from respondents within the same neighborhood who are presumably subject to the same environmental conditions.

Third, there is the report of the trained interviewer about the rapport and frankness of response. The mannerisms, inflections, gestures and general context of response are valuable clues to a trained observer of the honesty and sincerity of response.

It may be said that it isn't only a question of honesty of response but also of the predictability of following thru on intentions to complain. Election polls have, of course, provided valuable information on the relationships between intentions to vote and actual practices of voting. Intensity of feeling, certainty of convictions and ease of facilitating circumstances are generally considered important variables. It is proposed to study these and other factors facilitating

and inhibiting expression of annoyance feelings in any future research (See Qs. 22-27 of Appendix I). An internal analysis of these factors in terms of reported actual historical behavior of having complained in the past will provide valuable clues as to the dynamics of feelings and the expression of such feelings.

A second test will be the historical behavior of individuals with respect to non-aircraft disturbances (See Q. 28 of Appendix I). Whether a person ever was moved to complain and under what circumstances he acted or didn't act can be determined from a factor analysis of answers to this question.

A third test will be the relationship between reported intentions to sign a petition, calling or writing or attending a meeting on aircraft noise (See Q. 29 of Appendix I), and actual past behavior.

There are several problems involved in contriving an experimental test situation which actually measures a behavioral decision. In the NACA pre-test in New York, the interviewer left a postcard with each respondent and suggested that a local group, the National Air Transport Coordinating Committee was interested in hearing their views. This experiment was a failure for several reasons. In the first place, the sponsorship of the test was suspicious. After insisting that the survey was neutral and not connected with any airlines, etc., the interviewer indicated a relationship to the airlines. Secondly, the test offered no indications of a bona fide group effort, which most campaigns would involve. The individual was asked to express an individual opinion and since most persons felt individual efforts were futile, it was to be expected that few would write. Third, valid campaigns are usually spread over a considerable period of time and all sorts of group pressures are gradually directed at individuals before they are faced with the critical decision of supporting or not supporting a drive.

The experience with the contrived post card campaign indicates that any future test should consider the following four factors:

- 1) Bona fide sponsorship by local community leaders
- 2) Sufficient time for usual build-up of educational campaign
- 3) Active participation by local people and not by NORC interviewers
- 4) All residents should be involved, not only NORC respondents.

Of course, there is the added administrative problem of artificially creating a protest movement and of being able to control it. Before any such contrived test is attempted an analysis should be made of aircraft operations and the possibilities of actually reducing the disturbance. Obviously without sufficient control, a test could easily boomerang.

It is our belief that sufficient knowledge has been obtained in this exploratory research to sharpen our conceptual understanding of the annoyance and complaint problems. In our judgment the proposed questionnaire included as Appendix I of this report is a feasible instrument for obtaining the necessary data from which an appropriate analytical matrix can be developed. The final section of this report will analyze in detail the derivation of the proposed questionnaire, Appendix I.

A. General Structure of Questionnaire

One of the major problems involved in devising a standard questionnaire is the arrangement of questions in a natural sequence. Certain questions frequently stimulate a typical pattern of thought and unless the questionnaire is organized to correspond with the natural flow of answers, interviewing problems are increased. In analyzing the spontaneous intensive interviews, great care was taken to determine these normal patterns of response and to adapt them in the design of the questionnaire.

In general, the questionnaire is divided into five major units:

- 1) General open discussion about feelings involved in living in the neighborhood.
- 2) Direct questions about the noise environment.
- 3) Direct questions about aircraft operations in the area.
- 4) Questions about overt expressions of annoyance with noise, aircraft and other local disturbances.
- 5) Personal data and experiences with noise and aircraft phenomena.

Each unit has a similar structure which begins with open free-answer questions and proceeds to more specific direct questions. This approach gradually introduces each topic, permits a spontaneous discussion of ambivalent feelings and indicates the relative salience of various factors. It generally puts the respondent at ease since it permits him to think about the overall features of the problem and to emphasize the particular aspects which he, himself, feels are important. Another important advantage is the likelihood that the general discussion will include voluntary reports of some of the detailed aspects of the problem and it will appear less prying for the interviewer to follow up these leads with more specific probes. It has been our frequent experience that when interviews begin "cold" with very specific and detailed questions, that respondents become suspicious and less willing to express their frank opinions.

Following ample opportunity for spontaneous mention of airplanes and noise, a series of uniform questions is asked about the component aspects of the problem. If these disturbances are not voluntarily reported, the direct questions serve as a last resort. In this way, not only can the content of the answers be analyzed but the sequence of different answers can also be studied for salience and intensity of feelings. In all cases, however, the direct questions will provide detailed answers for the varied components and, thus, will facilitate the development of intensity and analytical scales.

As has already been discussed in earlier sections, the intensive interviews were first used to develop the conceptual framework of the jet problem. The second phase involved the phrasing of specific questions which would provide the information required to test the validity of these concepts. The final phase concerned the organization of these questions into a workable questionnaire and

pretesting for clarity, interest, natural sequence, overlap, practicality of form and length of interview, etc. The results of each pretest were carefully evaluated and many changes were made in the light of practical interviewing experience. It would be extremely time consuming to explain every technical change involved in the three major revisions of Appendix I. Actually, all of the experimental variations were never recorded since the pretest interviewers were at liberty to introduce many little changes in each interview. The following discussion, therefore, will present the purposes of each group of questions in terms of the conceptual framework and will describe only the major developmental changes in the format of the questionnaire. One general factor might be emphasized at the outset as applying to all questions. The initial questionnaire required a three hour interview and, since it was necessary to reduce this period to an hour or, at most, an hour and a half, there was constant pressure to consolidate and eliminate marginal questions.

B. Discussion of Individual Questions

Question 1. The interviewer was instructed to use the standard introduction, which is vague and gives no hint of the real purpose or sponsorship of the survey. He then proceeds to the first question as soon as possible, often using it as an illustration of the type of questions involved in the study. It has been found to be an "easy opener", and helps set the respondent at ease with a simple and familiar topic of discussion. The question also has an independent objective of indicating the generalized net feelings about the residential area before they are possibly colored by the discussion of particulars. A second summary measure of these over-all feelings is obtained in Question 20, after an extensive probing of specific feelings about the area. It will be interesting to discover whether these two questions elicit divergent answers and whether there is a tendency for the first question to have an upward bias.

Originally, a three-point scale was used as follows: "Well in general, how do you like living in this part of (). . . would you say you like it very much, that you like it a little. . . or that you don't like it?" It was found that 77% answered, "like very much", 16% answered, "like a little", and only 7% answered, "don't like it". In order to get a less skewed distribution, the question was rephrased with the following four alternatives: "In general, how do you like living in this part of (). . . would you say that you like it very much. . . that you like it a little. . . or that you dislike it a little. . . or that you dislike it very much?" It was found that answers were still concentrated at the upper end of the scale, and that there was some apparent confusion between "like a little", and "dislike a little". It was suggested that perhaps the phrase, "How do you like living. . ." had an upward bias, and that the substitution of "feeling" might be more neutral. Likewise, the traditional ratings of "excellent", "good", "fair", "poor", and "very poor" were substituted for the ambiguous four-point scale, and it was found that a better range of answers was obtained.

Another important technical point involves the place name used in these questions. It has been found that the place name inserted in parentheses provides the geographic framework for all ensuing questions. Our interest is in the immediate residential area which is broad enough to encompass facilities and services that are available for normal residential activities. In some instances the name of a neighborhood is the appropriate frame of reference; in other instances, an entire community or portion of a county is the natural grouping. Such general descriptive terms as neighborhood, locality, community, town, etc., have been found to produce a variety of interpretations and to anchor discussion on certain physical aspects of the area. Airplanes, for example, which involve flights over an area, are usually not thought of as part of the area but rather as intrusions on the area. Consequently, they may not be viewed as problems of a neighborhood, but as impositions on a geographical area. By using the actual name of a locality, it is believed that attention will be focused on all conditions affecting the area, whether or not they are considered intrinsic to the geographic boundaries of the area.

Question 2. If a respondent gave a net positive over-all rating, it was found easier to discuss the positive aspects of the area first and then the negative ones. If on the other hand, he gave a negative over-all rating the interviewer asked about the negative aspects first. During the intensive interviews it was found that respondents frequently used certain key words to describe various aspects of residential living. Some of these key phrases were: like, enjoy, good place, desirable place, pleasant place, advantages, satisfied, etc. Four of these phrases proved most productive in stimulating free response and in view of our desire to reduce the length of the interview, these were combined into two standard sub-questions.

It will be noted that the two parts of the question are printed together without writing space between them. This arrangement was found convenient because the length of the answers to each part varies unpredictably. With this format, it is possible to make optimum use of the limited space. Naturally, the interviewer is instructed to key each answer to the appropriate question.

It will also be noted that Questions 2-6 are all free-answer questions which permit a spontaneous open description of the respondent's feelings about the area.

Question 3. This question compliments Question 2, and is designed to stimulate unprompted discussion of the negative aspects of living in an area. Originally over a dozen different key phrases were pretested, and the most efficient were eventually consolidated into the five standard probes. Some of the initial projective type questions were omitted from the final draft only because they generally involved more time to answer and it was felt that an over-all balance might not justify additional questions to this first phase of the interview.

One of the problems encountered with Questions 2 and 3 involved the natural tendency to discuss both negative and positive aspects simultaneously. Since it is our intention to stimulate spontaneous discussion, this practice could not be entirely discouraged. In the NACA study, the answers to the two questions had to be coded together to ensure completeness in response.

Another related problem involved the amount of desired detail interviewers should obtain on these initial answers. In an intensive interview, the respondent's own answers are generally the basis for each succeeding question, but in a structured interview such intensive probing often anticipates future questions and results in undesirable duplication of response. On the other hand, the purpose of these open questions is to find out what is most salient and significant to a person. A compromise which worked well was to pursue each answer until it was clear and concise, but not to press for elaborations or additional details. For example, a typically ambiguous answer to Question 3 might be the cryptic remark, "the airport", "the jets", "the noise". The interviewer was instructed to probe until the particular aspects of the disturbance were stated. The interviewer might ask, "What about the airport? . . . In what way does it bother?" It is important to establish whether it is noise, danger, congestion, property values, etc. But it is also important that all probes are neutral, and that no particular aspects are suggested by the interviewer.

Question 4. Part A utilizes an aided recall technique to secure a uniform set of intensity ratings on the most frequently mentioned problems involved in residential living. An analysis of these ratings can reveal much about the dynamics of over-all net positive and net negative attitudes. In some instances a number of these items may have been voluntarily mentioned in Questions 2 or 3. In all cases, however, a uniform set of intensity ratings are requested, so that it will not appear to be a complete duplication of the previous questions.

The order of Parts A and B was initially reversed but it was found that most respondents started to rate their present feelings even though the question was phrased in terms of ideal conditions. It was decided, therefore, to conform to this "natural" order and begin with current ratings. Another reason for reversing these sections was the necessity for simplifying the question. Requesting respondents to rate their ideal values as well as present feelings about the residential area was too time-consuming and involved considerable duplication. Since many people have never thought in terms of ideal conditions, it was found that ratings about concrete present circumstances were both easier to obtain and more complete.

Two other technical points might also be mentioned. The rating "excellent" was changed to "very good" because it was found that the former term was often interpreted more rigorously and that most responses tended to cluster in the "good" category. Upon more intensive follow-up, it was found that a condition was often considered "excellent" only if it was beyond any improvement and very few people were willing to admit such perfection. On the other hand, "very good" implied a superior condition which could still be improved, so that greater differentiation of response was achieved by using the latter category. The other technical point involved the format of the question, i.e., providing additional space between items. It was found that if the specific living conditions had not been voluntarily discussed, the initial mention frequently would stimulate verbatim comments about the item. Consequently, space was provided to record these important comments.

Part B is a simplified version of the description of ideal values for residential areas. Rather than requesting a comment about each listed factor, the

respondent is asked to report three or four of the most important. Likewise, he is not limited to the aided-recall list, but may mention any other factors which are not included on the list.

Questions 5 and 6. These two questions attempt to refine further the intensity ratings reported on Part A of Question 4. It was found that insufficient differentiation was often secured on Question 4 and having given the respondent additional time to think about the varied aspects of living in an area, it is easier to secure the more selected comparative ratings on the next question. Likewise, by asking loosely about "Which ones?" rather than requesting the selection of a particular number of items in a given hierarchy of importance, the question is simplified. When the question was phrased in terms of "the one liked best", "the next best" and the "third best", many respondents balked at being pinned down or took a long time in making their decisions. The more general approach is shorter and eased the tension previously encountered.

Parts B of Question 5, and C of Question 6 inquire about the extent to which the advantages and disadvantages were anticipated before moving to the area. Part B of Question 6 is another measure of the intensity of feeling. By combining answers to Question 4 and this section of Question 6, it should be possible to rank the dislikes in numerical order. It will be recalled that respondents were reluctant to make such a specific ranking themselves.

Originally the last question of Question 6 asked all respondents to compare airplane or noise annoyance with those disturbances selected as the most important if airplane or noise problems had been mentioned on previous questions but had not been selected among the three most important problems. It was decided to postpone this forced comparison until Question 18, after the respondent had a chance to think about the direct questions on the airplane stimulus.

Question 7. This is the first direct question about the noise environment and aims principally at the respondents over-all assessment of the noise level. It should be noted that no hint is given about any particular type of noise, but our pretest experience indicates that many respondents tend to make a distinction between "noise in general" and some particularly intense noise, such as jet aircraft. This information is very interesting, but we also want the over-all rating including the intense noise. Consequently space is provided for both contingencies.

Question 8. This is an open question about the respondents' perception of the noise environment. No indication is given initially about our interest in any particular type of noise. Since this is a screening question, however, and serves as the basis for the detailed probes in the following question, Parts B and C were added to insure that jet and propeller noises weren't accidentally overlooked. In pretest interviews, some respondents failed to mention jet noise on the open question, and, consequently were not asked about any of the detailed aspects of jet noise. But when airplanes were first mentioned directly on Question 11, they indicated amazement at having overlooked mentioning the plane noise previously. To forestall such forgetfulness, the direct probes were included. The particular form of these probes was simplified and the coding was made applicable to all respondents so that the interviewer could check the completeness of each answer.

The decision to limit the direct probes to airplane noises and to exclude auto and truck noises from this special treatment was primarily due to our desire to cut the length of the interview. Actually, however, there tend to be fewer forgetful omissions of these latter noises, so that little detail is lost.

Question 9. This is the first direct question concerned with feelings about noises. It will be noted that all noises voluntarily mentioned are afforded uniform treatment, thus accomplishing two objectives. First, comparative detail is recorded on the annoyance process of different kinds of noises, and second, our special interest in aircraft noise is effectively masked.

Part A provides an over-all measure of intensity of bother for each noise. Pretest experience indicated that some respondents will balk at the word "bother", but will still feel that the noise is unpleasant and unwanted. It appears as if this tendency is frequently related to an intense desire "to make the best" of the disturbance, but it also may be partly a semantics problem. In any event, both contingencies are anticipated on the form.

It will be noted that this question was modified considerably in the course of pretesting; the format was simplified, a number of parts were consolidated, and others were added and omitted. Originally the question began with the open probe about the description of each noise. Our interest in this question was varied but it was principally designed to elicit comment about the tone quality of the noise. Actually, since answers were more often in terms of activities bothered, thus duplicating other questions, this section was eliminated.

Likewise, in earlier drafts the subject of bother was eased into after several probes about "unpleasantness", "disliking", etc. It was found, however, that at this stage of the interview, answers were spontaneously given in terms of degree of bother so that it was decided to consolidate these sections. It was also found that some respondents maintained that they were not currently bothered but that they used to be bothered in the past. To get at this reported adaptation process, Parts A3 and A4 were added.

In accordance with our general scheme, Part A5 is an open question about the character of the annoyance. No lead is given of our interest in any particular aspects of the problem. Part A6 has been added to establish the reported trend in personal feelings.

The rest of Question 9 focuses attention on the perceptual characteristics of each noise. An analysis of such physical parameters as frequency, regularity, and intensity of both annoying and non-annoying noises may shed some light on the annoyance process. Part E also explores the intensity of expectation of the disturbance. As in the other sections of this questionnaire, respondents tended to consolidate certain sub-questions in their answers, so that the final format also reflects these changes.

Question 10. This question consists of detailed direct probes about the character of the disturbance and the activities affected. Some of the items may have been volunteered in the open questions but many of them will be mentioned for the first time. In fact, our experience indicates that some respondents who

deny any bother or annoyance will actually indicate specific disturbances in answer to these detailed probes. That is one of the reasons why these questions are asked of all respondents. It will be noted, however, that the standard historical probe, "Did they ever (bother) in the past?" is omitted. In most instances, past experiences are volunteered and a direct question becomes unduly repetitious. Another pretest change involved the separation of questions about speech from listening to radio or TV. In the latter case compensatory changes can be made in volume control to minimize bother. In the case of speech, however, shouting itself is usually considered unpleasant.

One other aspect of this question dealing with "fear reactions" might be mentioned briefly. In the MACA study there was often considerable reluctance to admit feelings of fear as a sign of personal weakness. Consequently, there was some skepticism about asking directly about these intense emotions. The pretest experience, however, indicated that if the direct question followed a lengthy open discussion about airplanes and noise and after good rapport had been established that there was less reluctance to discuss openly fear reactions.

Question 11. This is the first direct question about airplanes. When the respondent has already mentioned them in previous questions, it may be slightly repetitious. However, the question is asked of everyone to insure uniform stimulation and to facilitate the use of the information in the development of analytical scales. The several parts concern perceptual characteristics of slant-distance and frequency of flight. Part F also includes a question about awareness of flight patterns and feelings about the necessity of airplanes going by. It will be noted again that the latter part of the question is "free-answer" since this is the first direct question about airplanes.

Question 12. The subject of this question concerns the respondent's knowledge and feelings about the importance of the missions assigned to the airplanes. While the probes are phrased in very personal terms, answers generally include references to national and community interests where such distinctions are relevant. As discussed previously, not only is the general importance questioned but also the necessity of the present location. Originally Part D was phrased in terms of a "better place". Pretest answers, however, indicated a general feeling that some improvement is always possible, and the answer was not always in terms of the present realities. Consequently, the question was rephrased into less-demanding terms of equal alternatives.

Questions 13-16. The next four questions inquire about the concern of pilots and officials for the welfare of the residents and of the avoidability of the disturbances. Question 13 concerns pilots and their ability to control the disturbance. Originally, this group of questions began with probes about specific regulations, but it was found that feelings about pilots are more general and easier to inquire about.

Question 14 deals with knowledge about the existence of specific rules to minimize the disturbance and whether they are violated by the pilots and authorities.

Question 15 inquires about the possible inter-personal effects of knowing persons associated with flying. Part B probes deeper for possible distinctions

between commercial and Air Force Pilots. Experience indicates that certain stereotypes of military personnel may influence one's confidence in the safety and necessity of specific operations.

Question 16 specifically relates to feelings about the concern of officials for the welfare of the neighborhood. Originally this section also included questions about specific knowledge of the authorities, but it was decided to treat these items in connection with a subsequent section on factors influencing expression of complaints.

Two additional questions summarizing feelings about noise and other environmental disturbances were omitted from the final draft in order to conserve time and to eliminate further duplication of response.

Question 17. Feelings about the comparability of exposure of different neighborhoods to the aircraft stimulus are revealed by this question. Our pretests show that residents who feel that everyone is exposed equally to a disturbance generally express more futility and less intense anger than residents who feel they are receiving a disproportionate share of a disagreeable stimulus. The validity of such findings could have an important bearing on preferential runway use and other operating decisions. Consequently, it was decided to add this question to the survey.

Question 18. As was mentioned previously, it was decided to include this forced comparison of aircraft and other disturbances at this point, in order to secure a comparative intensity rating for all respondents after the subject of airplanes had been fully covered. Experience indicates that if airplanes are considered even a minor problem, they will already have been reported as such in previous answers.

Question 19. As a follow-up on the comparative intensities of different environmental disturbances, this question inquires about the general philosophy of enduring and adjusting to physical discomforts. It is an open question which serves as a transition to the next battery of questions dealing with factors influencing expression of annoyance.

Questions 20-21. These two questions also deal with general questions and serve to ease the tension which may have developed from prolonged concentration on noise and airplane problems. The first provides us with a control rating on over-all net feelings about the area which may be compared with the first question. Question 21 discusses the general expectation of future conditions in the area. It will determine whether a respondent is generally pessimistic or optimistic about future living conditions. Such attitudes may be important in understanding current reactions to particular disturbances. If a condition is viewed as only temporary, it may not be worthwhile to raise a fuss about it, but if it is likely to get worse, it might be considered wise to complain now and possibly forestall the future situation.

Question 22. This is the first of a series of direct questions about the "complaint" process. Originally parallel treatment was provided for the three most serious problems mentioned by the respondent. Pressures of time made this desired approach impossible. As a compromise, the airplane disturbance is

The purpose of this question is to determine the respondent's belief in the physical possibility of improving the airplane situation. The question is made conditional by the addition of the phrase, "Where it is bothersome", and it is asked of all respondents.

Pretest experiences indicate that some persons who feel that it is impossible to improve the airplane noise and flight situation also reply that their immediate situation does not require any improvement. If the question of "physical possibility" is made contingent upon reported feelings of current bother, then it would be impossible to determine these feelings of futility and to establish any independent relationships between these two factors.

Even though many respondents reported little hope for a current solution, it was found that they were still generally optimistic about a future solution. This underlying faith in science is important in understanding feelings of partial and complete futility.

Question 23. This question deals with the respondent's knowledge of officials who are responsible for regulating aircraft activity. It establishes the extent of specific knowledge of appropriate channels of complaint and of images of the general concern of these officials about the disturbance.

Question 24. Originally only respondents who reported current bother were asked if they felt they could accomplish anything by complaining. This also excluded the group which had latent annoyance and prevented the independent study of annoyance feelings and factors inhibiting expression of annoyance. It was decided, therefore, to introduce the topic of "belief in personal ability" by asking all persons whether they ever felt like getting in touch with officials. If the answer is "yes", detailed questions are asked about actual behavior and the perceived results of such overt behavior. If a desire to communicate is reported but no action was taken, reasons for the discrepancy are ascertained by means of neutral open questions.

Question 25. In the previous question only persons who ever felt like complaining are asked about their belief in personally complaining. In order to secure for all persons this self image of personal ability to effect social change, a direct question is asked all respondents excluded in Question 24.

Questions 26-27. Feelings about social approval of complaints and social effectiveness of group action are systematically considered in these questions. First to be ascertained are the feelings and overt behavior of neighbors. Then questions are asked about the existence of local organizations, of the respondent's membership in such groups, and of the group attitudes and behavior with respect to airplanes. Most of these questions are in free answer form and it is hoped that general feelings about complaining and experiences with complaints will be obtained as well as specific information on airplane experiences.

Question 28. Since it was impossible to secure detailed information on complaints about other non-airplane problems, it was decided to ask this summary

question about such experiences. The answers to this question can serve as a general experimental control and can provide valuable data on the over-all complaint process. The overt behavior of respondents who indicated serious concern about other problems can be evaluated in terms of the action taken with regard to the jet aircraft problems. Any special factors affecting complaints about airplanes can then be determined as well as any universal factors which apply to all local problems.

Question 29. This question deals with a general readiness to behave under certain assumed situations. It not only concerns general feelings about the expression of annoyance, but attempts to distinguish between various forms of expression.

Questions 30-31. Expectations of remaining in the area, and reasons for wanting to move are considered in these two questions. Direct questions about personal feelings are asked first; then, a projective type question is asked about neighbors and their feelings.

Questions 32-43. The remaining twelve questions are self-explanatory and deal with typical demographic variables and personal experiences with noise and flying in other neighborhoods and jobs.

Question 44. The last question is a catch-all open question and gives the respondent a last opportunity to comment about any phase of the interview that he feels requires elaboration.

The personal interview schedule does not deal directly with the general factors affecting community action. Indirect information on the ease of reaching government officials, of convincing them, and of past experiences in attempting to secure their support may be furnished in terms of each respondent's perception of the community situation. Independent measures of the community are required, however, and would have to be obtained from an over-all sociological study of the community. The personal interview questionnaire, however, does deal with the complex of variables which affect individual behavior. It is our belief that it can be used as a research tool for obtaining the necessary empirical data for establishing the definitive statistical relationships of the many factors affecting the annoyance and complaint process.

PROPOSED QUESTIONNAIRE

NATIONAL OPINION RESEARCH CENTER
University of Chicago

Respondent No. _____

Time interview began _____
ended _____

 Hello. I'm from the opinion research center at the University of Chicago.
 We are doing a study about how people feel about living in different places, and
 I'd like to get some of your views.

1. In general, how do you feel about living in this part of (). Do you rate
 it as excellent, good, fair, poor, or very poor -- as a place to live?

Excellent	1*
Good.	2*
Fair.	3*
Poor.	4**
Very poor	5**
Don't know.	6**

*IF "EXCELLENT, GOOD, OR FAIR", ASK Q. 2 AND Q. 3

**IF "POOR", "VERY POOR", OR "DON'T KNOW", ASK Q. 3 FIRST AND THEN Q. 2

-
2. A. What are some of the things you like about living around here -- things
 that you feel are advantages or that make this a good place to live?
- B. Have we overlooked anything that you feel makes this a pleasant place
 to live? (Any others?)

NOTE: ASK EVERYONE PARTS A, B, C, D, AND E. WRITE "A" BEFORE THE ANSWER TO PART "A", ETC.

3. A. Now what are some of the things you don't like about living around here -- things you feel are sometimes nuisances or are unpleasant or disagreeable to you?
- B. Are there any other conditions that affect this area that bother, disturb, or annoy you at all?
- C. Now, you sometimes hear people say, "If you live around here you just have to expect such and so. . ." If you heard someone say that about living here, what sort of things would he probably be talking about?
- D. Have we overlooked anything -- even little things that are unpleasant or bothersome that you just take for granted because nothing much can be done about them?
- E. Taking everything into consideration, would you say this is a very safe place to live, or are there some dangerous conditions affecting this area? (Could you describe them to me?)

4. Now to be sure I have all your feelings straight. Here is a list of advantages which some people have said they like to have in a residential area.

A. I'd like you to look at each of these advantages and then tell me how you would rate this area in terms of actually having them. For example, would you say this area was very good, good, fair, poor or very poor in terms of being "close to your work or place of business? (How about "good schools?" etc.)

	<u>Very Good</u>	<u>Good</u>	<u>Fair</u>	<u>Poor</u>	<u>Very Poor</u>	<u>Don't Know</u>
a. Close to work or place of business. .	1	2	3	4	5	6
b. Good schools.	1	2	3	4	5	6
c. Quiet--no loud or unpleasant noises .	1	2	3	4	5	6
d. Convenient shopping	1	2	3	4	5	6
e. Clean, healthy, pleasant surroundings	1	2	3	4	5	6
f. Reasonable taxes or rent.	1	2	3	4	5	6
g. Good roads and transportation facil..	1	2	3	4	5	6
h. Convenient recreation & entertainment	1	2	3	4	5	6
i. Safe area	1	2	3	4	5	6
j. Friendly neighbors.	1	2	3	4	5	6
k. Land for garden, work, and play space	1	2	3	4	5	6

	<u>Very Good</u>	<u>Good</u>	<u>Fair</u>	<u>Poor</u>	<u>Very Poor</u>	<u>Don't Know</u>
l. Good sewage and sanitation services .	1	2	3	4	5	6
m. Close to church	1	2	3	4	5	6
n. Good local government	1	2	3	4	5	6
o. Attractive, well-kept homes	1	2	3	4	5	6

4. B. Now if you could pick an ideal place to live, which three or four advantages would you want to have above all others?

5. A. Now, of all the things that you actually like about living around here. . all the things that are pleasant or that you'd consider advantages -- which ones are most important to you? (Any others?)

B. Before you moved here, did you expect to find any of these advantages here?

Yes	1*
No.	2
Never lived elsewhere .	3
Don't know.	4

*IF "YES", ASK C:

C. Could you tell me which ones? (Any others?)

6. A. Now let's rate some of the things you actually don't like...of those you consider unpleasant, bothersome, or disadvantages, which ones do you dislike most? (Any others?)

NOTE: Number the dislikes 1,2,3 etc. and ask B-D

- B. How often do you think of (1st dislike, etc.) as a problem -- would you say very often, fairly often, or only occasionally?

	<u>1st</u> <u>Dislike</u>	<u>2nd</u> <u>Dislike</u>	<u>3rd</u> <u>Dislike</u>	<u>4th</u> <u>Dislike</u>
Very often.	1	1	1	1
Fairly often.	2	2	2	2
Occasionally.	3	3	3	3
Don't know.	4	4	4	4

- C1. Before you moved here did you expect to find any of these disadvantages around here?

Yes 1*
 No. 2
 Never lived elsewhere . 3
 Don't know. 4

*IF "YES", ASK C2:

C2. Could you tell me which ones?

- D1. Were there any other disadvantages that you expected to find around here?

Yes 1**
 No. 2
 Don't know. 3

**IF "YES", ASK D2

D2. Could you tell me which ones?

7. A. Now how would you rate the noise around here -- in general, would you say it's Very Noisy, Fairly Noisy, Fairly Quiet or Very Quiet?

NOTE: If no qualification is given, enter "None" in the blank space (Except for _____) and the rating given.

*If answer is "Except for _____ noise it's _____." Enter the qualified noise and the overall noise rating, then ask B.

Except for _____

Very Noisy.	1
Fairly Noisy.	2
Fairly Quiet.	3
Very Quiet.	4
Don't know.	5

- *B. Now including the _____ noise, how would you rate it -- would you say it's Very Noisy, Fairly Noisy, Fairly Quiet, or Very Quiet?

Very Noisy.	1
Fairly Noisy.	2
Fairly Quiet.	3
Very Quiet.	4
Don't know.	5

8. A. Could you tell me (again) what kinds of noises or sounds you usually hear around here? (Any others?)

NOTE: Record verbatim comments about the "kinds of noises", then be sure to list each noise below in Q. 9.

Also find out whether the respondent ever hears jet and propeller planes in flight and on the ground and circle the appropriate items. Unless a "Yes" or "No" answer is spontaneously given to each of the four items, Ask B & C as they apply:

- B. Do you (also) ever hear (jet and/or propeller) planes fly by here?

- C. Do you ever hear (jet and/or propeller) planes warming up or testing their engines?

	B. Flight			C. Ground		
	Yes	No	Don't Know	Yes	No	Don't know
Jets heard.	1	2	3	1	2	3
Propeller heard	1	2	3	1	2	3
Planes heard -- types unknown	1	2	3	1	2	3

9. Now let's see if we have all the noises and sounds you hear around here --

NOTE: Go over answers to Q. 7 and Q. 8, reading aloud the noises and sounds mentioned, and recording each noise below: Then ask A for each noise mentioned, then B.....etc.

A1. Does the _____ noise bother you very much, moderately, only a little, or not at all? (How about the (second noise)? etc.)

	Kinds of Noise					
	1.(____)	2.(____)	3.(____)	4.(____)	5.(____)	6.(____)
Very much. . .	1***	1***	1***	1***	1***	1***
Moderately . .	2***	2***	2***	2***	2***	2***
A little . . .	3***	3***	3***	3***	3***	3***
Not at all . .	4*	4*	4*	4*	4*	4*
Don't know . .	5*	5*	5*	5*	5*	5*

*IF "NOT AT ALL", OR "DON'T KNOW", ASK A2 AND A3 IMMEDIATELY.

A2. Now if it came to a choice would you say you like having the noise, or that you'd rather not have it?

	1.(____)	2.(____)	3.(____)	4.(____)	5.(____)	6.(____)
Like it. . . .	1	1	1	1	1	1
Not have it. .	2***	2***	2***	2***	2***	2***
Don't care . .	3	3	3	3	3	3
Don't know . .	4	4	4	4	4	4

A3. Was it ever unpleasant or did it ever bother you at all in the past?

	1.(____)	2.(____)	3.(____)	4.(____)	5.(____)	6.(____)
Yes.	1**	1**	1**	1**	1**	1**
No	2	2	2	2	2	2
Don't know . .	3	3	3	3	3	3

**IF "YES" TO A3, ASK A4 AND, THEN, ASK PART A1 ABOUT NEXT NOISE.

A4. Could you tell me about it -- how you got used to it? (How did it happen? How does it work?)

9. (continued)

***IF BOTHERS "VERY MUCH", "MODERATELY" OR "ONLY A LITTLE" OR "RATHER NOT HAVE IT" ON A1, ASK A5 AND A6.

A5. Could you tell me just how you feel about that () noise -- in what way does it bother you? (Why would you rather not have it? How would you describe your feelings to a friend who was thinking of moving here and asked you about it?)

NOTE: List number of noise before each answer.

A6. Does the () noise bother you more than it used to or not as much?

NOTE: Enter any qualification, if given, in parenthesis () by each number.
(Except for.....)

1.() 2.() 3.() 4.() 5.() 6.()

More	1*	1*	1*	1*	1*	1*
Not as much. .	2*	2*	2*	2*	2*	2*
Some	3*	3*	3*	3*	3*	3*
Don't know . .	4	4	4	4	4	4

*Why is that?

9. (continued)

ASK EVERYBODY PARTS B-D FOR EACH NOISE MENTIONED.

B. How often do you hear the () noise around here -- would you say very often, fairly often, or only occasionally? (How about the second noise?)

1.() 2.() 3.() 4.() 5.() 6.()

Very often . .	1	1	1	1	1	1
Fairly often .	2	2	2	2	2	2
Occasionally .	3	3	3	3	3	3
Don't know . .	4	4	4	4	4	4

C1. Does the () noise ever seem very loud or is it always fairly low?
(How about the 2nd noise?)

1.() 2.() 3.() 4.() 5.() 6.()

Very loud. . .	1*	1*	1*	1*	1*	1*
Moderately loud	2*	2*	2*	2*	2*	2*
Fairly low . .	3	3	3	3	3	3
Don't know . .	4	4	4	4	4	4

*IF "VERY LOUD" OR "MODERATELY LOUD", ASK C2:

C2. Is it (very loud, moderately loud) very often, fairly often, or only occasionally?

1.() 2.() 3.() 4.() 5.() 6.()

Very often . .	1	1	1	1	1	1
Fairly often .	2	2	2	2	2	2
Occasionally .	3	3	3	3	3	3
Don't know . .	4	4	4	4	4	4

D. Do you usually hear the () noise more on Saturdays or Sundays than on week days -- or is it always about the same? (How about the (2nd noise)?)

1.() 2.() 3.() 4.() 5.() 6.()

More on Sat.or Sun.	1	1	1	1	1	1
More on Week Days .	2	2	2	2	2	2
More on () .	3	3	3	3	3	3
Always same	4	4	4	4	4	4
Don't know.	5	5	5	5	5	5

9. (continued)

E1. Now we may have already covered this, but did you have any idea that you would find any of these noises here, before you moved here? (Which ones?)

1.() 2.() 3.() 4.() 5.() 6.()

Yes	1*	1*	1*	1*	1*	1*
No	2	2	2	2	2	2
Noise started						
after .	3	3	3	3	3	3
Don't know . .	4	4	4	4	4	4

*IF "YES", ASK E2:

E2. Is it worse than you expected, not as bad, or about the same as you expected?

1.() 2.() 3.() 4.() 5.() 6.()

Worse	1	1	1	1	1	1
Not as bad . .	2	2	2	2	2	2
Same	3	3	3	3	3	3

10. Well, I have a pretty good idea of how you feel about these noises, but could you tell me:

A1. Do any of them ever frighten or startle you at all?

Yes	1*
No	2
Don't know	3

*IF "YES", ASK A2 AND A3:

A2. Which one(s)?

A3. Could you tell me about any particular experiences that stand out in your mind (for each noise mentioned?) (How long ago was that?) (How often do you feel that way?)

10. (continued)

B. Do any of these noises ever wake you up or keep you from going to sleep?
(which ones?)

Yes 1
No. 2
Don't know. 3

C. Do any of them ever disturb you when you are trying to rest or relax?
(which ones?)

Yes 1
No. 2
Don't know. 3

D. Do they ever make the TV flicker?
(which ones?)

Yes 1
No. 2
Don't know. 3

E. Do any of them ever interfere with your talking to other people on the
telephone or in normal conversation? (which ones?)

Yes 1
No. 2
Don't know. 3

F. How about listening to the TV or radio -- do any of them ever make it
more difficult for you to do these things?

Yes 1
No. 2
Don't know. 3

G. Do any of them ever make the house vibrate or shake?
(which ones?)

Yes 1
No. 2
Don't know. 3

11. A. Do the airplanes ever seem to fly right overhead when they pass by here?

Right overhead.	1*
Never overhead.	2**
Don't know.	3

*IF EVER "OVERHEAD", ASK B-C USING WORD "OVERHEAD".

**IF "NEVER OVERHEAD", ASK B-E USING WORD "BY".

B. Do they seem to fly (overhead) (by) very often, fairly often, or only occasionally?

Very often.	1
Fairly often.	2
Occasionally.	3

C1. When they fly (overhead) (by) do they ever fly very low, or are they always pretty well up?

Fly low	1***
Well up	2
Don't know.	3

***IF "FLY LOW", ASK C2:

C2. Do they fly very low very often, fairly often, or only occasionally?

Very often.	1
Fairly often.	2
Occasionally.	3
Don't know.	4

D. How do you feel about it when they fly (by) (very low)?

E. Do you have any idea why they fly (by) (low) here?
(why is that?)

12. A. Do you have any idea or impression of the sort of jobs assigned to the airplanes around here? (Why do they have them here?)

Yes	1*
No.	2

*IF "YES", ASK B:

B. What are they?

NOTE: Number each different "job" mentioned 1,2,3,4 etc. and ask about each in Part C and D.

12. (continued)

C. As far as you are concerned, how important do you feel (each job -- or if "No" to 12 A, whatever they do) is -- would you say it's very important, moderately important, or hardly important at all?

	(Jobs) <u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>General</u>
Very important.	1	1	1	1	1
Moderately important. . . .	2	2	2	2	2
Hardly important.	3	3	3	3	3
Don't know	4	4	4	4	4

D1. Do you feel that (each job or what they do) has to be done at the airport near here, or could it just as well be done someplace else?

	(Jobs) <u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>General</u>
Done here	1*	1*	1*	1*	1*
Better place.	2*	2*	2*	2*	2*
Don't know.	3	3	3	3	3

*D2. Why is that?

13. A. Do you suppose that pilots care very much about the feelings of people, like yourself, when they fly by here?

Yes	1*
No.	2*
Don't know.	3

*B. Why do you feel that way?

C. Do you think that pilots can do anything about the way they fly over here -- can they fly higher, or make less noise if they want to?
(Can you explain that a little more?)

14. A. As far as you know, are there any flight or ground rules that the planes are supposed to follow around here?

Yes	1*
No.	2
Don't know.	3

*IF "YES", ASK B-C:

B. What are they?

C1. Do you feel that they always pay attention to these rules?

Yes	1
No.	2**
Don't know.	3

**IF "NO" TO C1, ASK C2:

C2. How often do you feel that they don't -- very often, fairly often, or only occasionally?

Very often.	1
Fairly often.	2
Occasionally.	3
Don't know.	4

15. A. Do you happen to know of anyone connected with flying generally or with the airfield near here?

Yes	1*
No.	2
Don't know.	3

*IF "YES", ASK A2:

A2. Could you tell me who they are and what they do?

B. Some people say that pilots for the commercial companies are much different than the Air Force pilots -- how do you feel about that?
(In what way are they different?)

16. A1. Do you think that the officials who make the rules for airplanes care about people, like yourself, who live near the airport -- would you say they are very concerned, moderately concerned, only slightly concerned, or not concerned at all with people like you?

Very concerned.	1*
Moderately concerned. .	2*
Slightly concerned. . .	3*
Not concerned	4*
Don't know.	5

*A2. Why do you say that?

- B. As far as you know, do the officials who make the rules do very much to enforce them or to punish violators? (What do they do?)

-
17. A. To the best of your knowledge, do you feel the airplanes around here are worse, not as bad, or about the same as other places near this airport?

Worse	1*
Not as bad.	2*
Same.	3*
Don't know.	4

*B. Why is that?

ASK ONLY IF NON-AIRPLANE PROBLEMS HAVE BEEN MENTIONED.

18. A. Now considering everything you've told me about the airplanes and the other things you dislike or consider disadvantages to living around here -- how would you rate the airplane problem in comparison with the other problems. Would you say it is more important, just as important, almost as important or much less important to you?

More important.	1*
Just as important . . .	2*
Almost as important . .	3*
Much less important . .	4*
Don't know.	5

*B. Why do you say that?

-
19. Some people say that you can get used to any noise if you just exercise your will power.....how do you feel about that? Why?

-
20. Now considering everything you've told me about things you like and dislike, would you pick out the number on this scale which best describes your over-all feelings about living here?

NOTE: Hand card to respondent and enter number selected.

-
21. A. In general, do you feel this will be a better area or a worse area to live in a few years from now?

Better.	1*
Worse	2*
Same.	3*
Don't know.	4

*B. Why is that?

22. A. At the present time, do you think that anybody connected with airplanes has the scientific know-how to improve the situation where it is bothersome?

Yes 1**
No. 2*
Don't know. 3*

*IF "NO", OR "DON'T KNOW", ASK A2:

- A2. Do you think someone may find a solution in the next few years?

Yes 1**
No. 2
Don't know. 3

**IF "YES", ASK A 3:

- A3. What do you think could be done?

-
23. A1. Do you have any idea whether there are any officials you could get in touch with, if you wanted to, about improving the airplane situation around here?

Yes 1*
No. 2

*IF "YES", ASK A2 AND A3:

- A2. Could you tell me who that is? (Any others?)

- A3. Do you have any idea how they feel about it?

24. A. Have you, yourself, ever felt like getting in touch with somebody about improving the airplane situation around here?

Yes 1*
No. 2****
Don't know. 3****

*IF "YES", ASK B-D

***IF "NO" OR "DON'T KNOW", ASK Q. 25

*B. Have you yourself ever called anyone, signed a petition or done anything else about it?

Yes 1***
No. 2**
Don't know. 3**

**IF "NO" OR "DON'T KNOW", ASK C:

C. Why is that? (Do you think that you and your neighbors could help get the people in charge to do something?)

***IF "YES" TO B, ASK D:

D1. What did they do? (Anything else?)

D2. When was that?

D3. Did it do any good? (What happened?)

*****IF "NO" OR "DON'T KNOW" TO Q. 24, ASK Q. 25:**

NOTE: IF "BOTHERED" BY AIRPLANES, START QUESTION USING, "DO YOU THINK....."

IF "NOT BOTHERED" BY AIRPLANES, START QUESTION USING, "SUPPOSE YOU WERE BOTHERED....."

25. A. (Suppose you were bothered) Do you think that you and your neighbors could help get the people in charge to do something?

Yes	1*
No.	2**
Don't know.	3**

***IF "YES", ASK B:**

B. What could you do? (How would you go about it?)

****IF "NO" OR "DON'T KNOW", ASK C:**

C. Why is that?

26. A. Could you tell me how your neighbors feel about the airplanes -- are any of them ever bothered or annoyed by them?

Bothered.	1*
Not bothered.	2
Don't know.	3

***IF "BOTHERED", ASK B:**

B. As far as you know, have any of them (your neighbors) ever tried to do anything?

Yes	1***
No.	2**
Don't know.	3

****IF "NO", ASK C:**

C. Why is that?

26. (continued)

***IF "YES", ASK D1-3

D1. What did they do?

D2. When was that?

D3. Did it do any good? (What happened?)

27. A. Are there any local groups or organizations around here that might take an interest in such problems?

Yes	1*
No.	2
Don't know.	3

*IF "YES", ASK B-G:

B. Which ones?

C. Do you happen to belong to any of them? (Which ones?)

27. (continued)

D. As far as you know are they concerned about the airplanes?

Yes	1***
No.	2**
Don't know.	3

**IF "NO", ASK E:

E. Why is that?

***IF "YES", ASK F-G:

F1. Do you think they could help to get something done?

Yes	1
No.	2****
Don't know.	3

****IF "NO" TO F1, ASK F2:

F2 Why is that?

G1. As far as you know have any of them ever tried to do anything about it?

Yes	1**
No.	2*
Don't know.	3

*IF "NO", TO G1, ASK G2:

G2. Why is that?

**IF "YES" TO G1, ASK G3-5:

G3. What did they do?

27. (continued)

G4. When was that?

G5. Did it do any good? (What happened?)

28. A. How about other local problems, other than airplanes, have you, yourself ever felt like doing something about them?

Yes	1**
No.	2*
Don't know.	3*

*IF "NO" OR "DON'T KNOW", ASK B:

B. Why is that?

**IF "YES", ASK C-D

C. Which ones?

D1. Did you ever do anything about them?

Yes	1****
No.	2***

***IF "NO" TO D1, ASK D2:

D2. Why is that?

28. (continued)

****IF "YES" TO D1, ASK D3-5:

D3. What did you do?

D4. When was that?

D5. Did it do any good? (What happened?)

29. ASK Q. 29 ONLY IF RESPONDENT IS OR WAS ANNOYED WITH AIRPLANES.

A1. Now suppose some of the local civic groups asked you to sign a petition asking the airplane officials to reduce their disturbance -- do you think that you would probably sign such a petition?

Yes	1
No.	2*
Don't know.	3*

*IF "NO" OR DON'T KNOW", ASK A2:

A2. Why is that?

29. (continued)

B. How about calling up or writing to these officials -- if you were asked to call or write about the disturbance, do you think you probably would?

Would	1
Would not	2**
Don't know.	3**

**IF "WOULD NOT" OR "DON'T KNOW", ASK B2:

B2. Could you tell me why?

C1. If they called a meeting to urge the officials to do something, do you think you probably would attend?

Yes	1
No.	2***
Don't know.	3***

***IF "NO" OR "DON'T KNOW", ASK C2:

C2. Why is that?

30. Could you tell me if you ever felt like moving away from this area?

Yes	1*
No.	2
Don't know.	3

*IF "YES", ASK B & C:

B1. Have you done anything about finding another place?

Yes	1**
No.	2
Don't know.	3

**IF "YES" TO B1, ASK B2:

B2. What have you done?

30. (continued)

C. Why have you felt like moving?

31. A. Do you know of anyone who has moved away in the past year or so, or is planning to move from this area?

Yes	1*
No.	2
Don't know.	3

*IF "YES" ASK B:

B. Do you happen to know why?

32. Now we have what we call background data, and we'll be through.

Are you usually in this neighborhood during the morning? The afternoon?
The evening? The night?

	<u>Yes</u>	<u>No</u>	<u>Don't Know</u>
Morning (8AM - 11:59AM)	1	1	1
Afternoon (12N - 5:59PM)	2	2	2
Evening (6PM - 10:59PM)	3	3	3
Night (11PM - 7:59AM)	4	4	4

33. A. How long have you lived in this part of _____? _____ years*

*IF LESS THAN 3 YEARS, ASK B AND C:

B. Where did you live just before moving here? (About how far is that from here?)

C. How long did you live there? _____ years

34. A. Now how would you compare the noise around here with the noise where you lived just before moving here -- Would you say it is noisier here, quieter, or about the same as your old neighborhood?

Noisier	1*
Quieter	2*
Same.	3*
Never lived elsewhere .	4

*ASK ONLY IF RESPONDENT HAS LIVED ELSEWHERE:

- B. What kinds of noise did you have in your old neighborhood?

NOTE: IF SOME NOISES ARE MENTIONED IN PART B, ASK C:

- C. Did any of the noises ever bother or annoy you in any way?

Yes	1*
No.	2
Don't know.	3

*IF "YES", ASK C2 AND C3:

- C2. Which ones?

- C3. In what way? (Did it bother you at all when you first experienced it? -- later, just before you moved?)

- D. About how long did you live there? (Enter answer to Q. 33C, if given)

_____ years

- E1. Did you ever live in any (other) noisy areas?

Yes	1**
No.	2
Never lived elsewhere .	3
Don't know.	4

**IF "YES", ASK E2:

- E2. How long ago was that?

_____ years

- E3. What kinds of noise did you have there?

34. (continued)

E4. Did any of them ever bother or annoy you in any way?

Yes 1***
 No. 2
 Don't know. 3

***IF "YES", ASK E5:

E5. In what way? (Did it bother you at first? Later, just before you moved?)

35. Family Composition:

Including yourself, how many people live with you in this house? _____
 Please list them for me.

Relation to head of family	SEX		AGE About how old is	RACE	
	M	F		W	N.W.
Self	M	F			
	M	F			
	M	F			
	M	F			
	M	F			
	M	F			
	M	F			

36. A. What sort of work does (main earner in the family) do?

Job:

Industry:

36. (continued)

IF RESPONDENT IS NOT MAIN EARNER, ASK B:

B1. Do you have a job away from your home?

Yes	1**
No.	2*
Don't know.	3

*IF "NO", ASK B2:

B2. Have you ever had a job outside your home?

Yes	1**
No.	2
Don't know.	3

**IF "YES" TO B1 OR B2, ASK B3:

B3. What sort of work is that?

Job:

Industry:

IF "NO" TO B1 AND "YES" TO B2, ASK B4:

B4. About how long ago was that? _____

37. IF RESPONDENT NOW WORKS OR USED TO WORK, ASK:

A. What would you say about the noise where you work (last worked) -- would you say it is (was) very noisy, fairly noisy, fairly quiet, or very quiet?

Very noisy.	1*
Fairly noisy.	2*
Fairly quiet.	3
Very quiet.	4

*IF "VERY NOISY" OR "FAIRLY NOISY", ASK B-D:

B. What kinds of noise do (did) you have?

C. About how long have you been working (did you work) there? _____

D. Did any of these noises ever bother or annoy you in any way?
(Which ones?) (In what way?)

37. (continued)

E. How would you compare the noise around here with the noise where you work(ed) -- would you say it is noisier here, quieter or about the same as where you work(ed)?

Noisier	1
Quieter	2
Same.	3
Don't know.	4

F1. How about any of your other jobs -- were any of them very noisy or moderately noisy?

Yes	1*
No.	2
No other jobs	3
Don't know.	4

*IF "YES", ASK F2-4:

F2. What kind of noise was it?

F3. How long did you work there? _____

F4. Did any of these noises ever bother or annoy you in any way?
(Which ones?) (In what way?)

38. Now what is the highest grade of school you completed?

Completed 0-4 years of grade school.	1
" 5-6 years of grade school.	2
" 7-8 years of grade school.	3
" 1-3 years of high school	4
" 4 years of high school	5
" 1-3 years of college	6
" 4 or more years of college	7

39. Here is a card with a list of typical family incomes. Could you tell me the one which comes closest to the amount that all members of your family earned last year. I mean how much money did they get all together from all sources -- before taxes and other deductions?

- | | |
|-------------------------------|---|
| A. under \$2,000 | 1 |
| B. \$2,000 - 4,000. | 2 |
| C. \$4,000 - 6,000. | 3 |
| D. \$6,000 - 8,000. | 4 |
| E. \$8,000 - 10,000 | 5 |
| F. \$10,000 and more. | 6 |
-

40. A. By the way, have you ever flown in a plane?

- | | |
|---------------------|-----|
| Yes | 1* |
| No. | 2** |
| Don't know. | 3** |

*IF "YES", ASK: B-C:

- B. About how many times?
- C. When was the last time?

**IF "NO", ASK D:

D. Has anyone in your family ever flown in one?

- | | |
|---------------------|---|
| Yes | 1 |
| No. | 2 |
| Don't know. | 3 |
-

41. A. How do you feel about flying?

B. What are some of the (other) things about flying you don't like so much?

C. Suppose you were invited to go for a ride in a jet plane -- how would you feel about it?

42. Do you happen to have a TV set in this house?

Yes 1
No. 2
Don't know. 3

43. Do you rent or own this house? (check one and get appropriate information)

____ Rent -- IF RENT, ASK: A. How much do you pay per month, including the cost of heat, light and cooking fuel?

\$

____ Own -- IF OWN, ASK: B. About how much would you say your home is worth today?

\$

44. Now I guess we're all through. Can you think of anything else you'd like to add to describe your feelings about living around here -- or do you think we already have a complete picture?

Name of Interviewer _____

Date: _____

PHYSICAL PARAMETERS OF JET AIRCRAFT NOISE COMPLEX

prepared by
BOLT, BERANEK AND NEWMAN, INC.
Cambridge, Massachusetts

This report presents preliminary data on the characteristics of the noise stimulus underneath jet take-off paths near air bases. This study is part of a broader research program on community aspects of annoyance by jet aircraft, conducted by the National Opinion Research Center. The principal objectives of the study reported herein are (1) to specify the primary stimulus variables that will control the selection of sampling areas for an opinion survey, and (2) to specify the stimulus variables that must be measured or evaluated in each sampling area in order to provide an adequate description of the stimulus.

The data in this report are given in brief, summary form. A report giving more detailed information, including measurement and computational procedures, is forthcoming.

Our discussion is limited principally to take-off noise, since the noise levels produced by aircraft during landing operations are substantially lower than the take-off noise levels.

Before we discuss the stimulus variables in detail we shall first list (1) the primary stimulus variables, i.e., the variables that will directly influence the selection of sampling areas, and (2) additional stimulus variables that must be evaluated in order to provide an adequate description of the stimulus in a given sampling area.

Primary Stimulus Variables

1. Average number of jet take-offs per day over the area.
2. Time schedule of jet operations over the area, especially relative frequency of take-offs in the daytime and at night.
3. Peak sound pressure level in the 300-600 cps frequency band as the aircraft pass overhead. (Since there will be considerable variability in the peak level, a statistical measure must be used, such as the median of the peak levels, or the peak levels that are exceeded by 25 percent of the aircraft. Cf Aircraft SNL defined previously. 1/)
4. Location of the sampling area relative to the flight path, i.e. either directly under the flight path or to the side of the flight path.

Additional Stimulus Variables

1. The length of time during which the level in the 300-600 cps band is within 10 decibels of the peak level; this time in seconds will be called

1/ Bolt Beranek and Newman Report No. 256, "A Survey of Background and Aircraft Noise in Communities Near Airports," 22 November, 1954.

2. The length of time during which the Speech Interference Level (SIL) exceeds a specified value, say 70db; this time in seconds will be called "duration of speech interference."

3. A measure of the variability of the peak level due to different types of aircraft, different weather conditions and different operational procedures.

4. Background noise level.

The first two of the primary stimulus variables relate to the time schedule and frequency of the jet operations. Past experience has shown clearly that the number of noise exposures and the time at which the exposures occur are of primary importance in determining community response to an intermittent noise, and hence must be included in the specification of the stimulus. The procedures for quantifying these aspects of the stimulus will not be discussed here since they are included elsewhere in the report of the National Opinion Research Center.

A measure of the peak sound pressure level as the aircraft pass overhead is certainly one of the most important stimulus variables. We have selected the peak levels in the 300-600 cps frequency band because such data correspond rather closely to the Aircraft Sampled Noise Level (SNL) used in a previous report. ^{1/} Since the noise spectra for jet aircraft can be predicted reasonably accurately if certain operating characteristics of the engines are known, it is possible to relate the peak levels in the 300-600 cps band to other measures such as the over-all levels or some combination of levels in other frequency bands.

The peak sound pressure level varies with distance from the end of the runway as the aircraft gains altitude. Estimates of peak sound pressure levels directly under an F-89C aircraft (with afterburner) taking off are given in Table VIII. The variation in peak level with distance from the beginning of the runway and the estimated range of variation are plotted in Fig. 2. The ordinate in this figure is the sound pressure level (in the 300-600 cps band) relative to the level measured at a standard distance of 400 feet and a speed of 250 knots (see Table IX).

These peak levels have been computed from measured noise source characteristics of the aircraft in level flight and from estimates of flight profiles for take-offs. Some measurements of the noise of actual take-offs have been made to provide partial verification of the data in the table. The measurement and computational procedures used to obtain the data in Table VIII will be described in a separate report.

Estimated altitudes and altitude ranges are also given in the table, and are plotted in Fig. 3. The altitude estimates were made after discussions with flight personnel and from operating data for the various aircraft. Fighter and light bomber aircraft are assumed. Variations in the altitudes are caused by differences in wind and temperature conditions, in aircraft type and in airport height above sea level. The altitudes and altitude ranges and the estimates of peak levels are tentative and must be verified by extensive observations of aircraft take-off operations.

Table IX summarizes the peak sound pressure levels in three frequency bands for several types of aircraft. The levels are corrected for an altitude of 400 feet and a speed of 250 knots.

From the data in Table VIII we have made a preliminary selection of sampling areas in which there will be significant differences in peak sound pressure level. The areas are shown in Fig. 4. There are four types of areas: The area with the highest peak levels (116 db in the 300-600 cps band for an F-89C with afterburner) is 3 to 4 miles from the beginning of the runway and it is about 1000 feet wide. The peak level is 10 db lower for an area 5 to 6 miles from the beginning of the runway and about 1/2 mile wide. A "control" area with a peak level of 86 db is located about 8 miles from the beginning of the runway. A fourth sampling area is selected on either side of the runway projection at the distances shown in the figure.* The extent of each area is selected such that the variation in peak level from point to point in any one area for a given take-off is ± 3 db. Superimposed on this variation there is, of course, the variation shown in Table VIII. The peak levels in the 300-600 cps band shown in Fig. 4 may be scaled up or down for different types of aircraft.

Let us now examine the secondary stimulus variables that must be specified in each sampling area in order to complete the description of the stimulus. The first two of these variables are concerned with the duration of the noise produced by one aircraft flying overhead. As the aircraft flies past, the sound pressure level on the ground rises to a maximum and then decreases. One measure of the duration of the noise is the period of time during which the sound pressure level in the 300-600 cps band is within a given number of decibels, say 10, of the peak level. For a low-flying aircraft and for a given speed this duration of the peak will be short; for higher altitudes the peak level will, of course, be lower, but the duration defined in this manner will be longer. The duration of the peak depends only on the speed of the aircraft and its altitude, and not on the magnitude of the peak level. Data on the duration of the peak for various distances from the beginning of the runway are given in Table VIII.

Previous studies have shown that interference with speech is often reported by people who live under aircraft flight paths and are exposed regularly to aircraft noise. Another significant measure of the duration of the noise from an aircraft flying overhead is, therefore, the length of time that the noise interferes with normal conversation. Interference with speech can be predicted reasonably accurately if the Speech Interference Level (SIL) of the noise is known. The SIL is defined as the average, in decibels, of the sound pressure levels in the octave frequency bands 600-1200, 1200-2400, and 2400-4800 cps. An SIL of 70 db measured out-of-doors would usually interrupt normal conversation; indoors the SIL would be 10 to 20 db lower, and conversation could usually be continued in a raised voice. We have defined the duration of speech interference as the length of time, in seconds, that the SIL exceeds 70 db as the aircraft passes overhead. Similar durations could be defined for other values of the SIL. Estimates of the duration of speech interference directly under F-89C take-offs are given in Table VIII. It is of interest to note that this duration is a maximum for an intermediate distance from the beginning of the runway. For aircraft that produce different peak levels these durations will be different.

The third secondary stimulus variable is the variability of the peak level.

* If the normal flight path is curved instead of straight, the horizontal axis of Fig. 4 represents distance along the flight path.

The variability from exposure to exposure depends upon the different types of aircraft and the variability of the operations and flight paths at a particular air base. It would not be unusual to find variations in peak level of + 10 db or more for a given sampling area, especially for the more distant sampling areas where the aircraft begin to deviate from straight flight paths. A measure of this variation must be given for each sampling area in order to provide an adequate specification of the stimulus. Statistical measurements would have to be made to determine the range of levels in each sampling area.

The final stimulus variable is the background noise level. In each sampling area statistical measurements of the background noise should be made in the daytime and at night.

TABLE VIII

PRELIMINARY ESTIMATES OF RANGES OF ALTITUDES, PEAK SOUND PRESSURE LEVELS AND DURATIONS OF NOISE FOR JET AIRCRAFT TAKING OFF. ALTITUDE RANGES APPLY TO FIGHTERS AND LIGHT BOMBERS. LEVELS AND DURATIONS ARE FOR F-89C AIRCRAFT WITH AFTERBURNER

Distance from Beginning of Runway Miles	Estimated Mean Altitude Feet	Estimated Altitude Range Feet	Peak SPL in 300-600 cps band for F-89C db re 0.0002 dyne/cm ²	Estimated Range of Peak SPL's db	Duration Within 10 db of peak sec.	Duration above 70 db SIL sec.
1	50	0-100	---	---	---	---
1- $\frac{1}{2}$	180	50-280	123	+11-4	1.2	7
2	270	150-400	119	+ 5-3	1.6	8
3	520	320-780	113	+ 5-4	2.9	10
4	800	500-1700	109	+ 5-7	4.2	12
5	1600	700-3100	103	+ 7-8	7.3	17
6	2900	1300-4400	96	+ 8-6	13	20
7	4200	2600-5800	91	+ 6-5	20	18
8	5600	4000-7200	86	+ 5-4	25	10

TABLE 1A

SUMMARY OF PEAK SOUND PRESSURE LEVELS IN THREE OCTAVE BANDS
OF FREQUENCY FOR VARIOUS JET AIRCRAFT. DATA ARE CORRECTED
FOR A SPEED OF 250 KNOTS AND AN ALTITUDE OF 400 FT.

		Peak SPL in Decibels re 0.0002 dyne/cm ²		
		75-150 cps	300-600 cps	1200-2400 cps
F-89C	A/B	107	116	110
F-89C	100%	99	110	106
B-57	100%	102	110	104
F-84F	100%	94	101	100
F-86E	100%	102	105	101
F-86E	80%	90	92	92

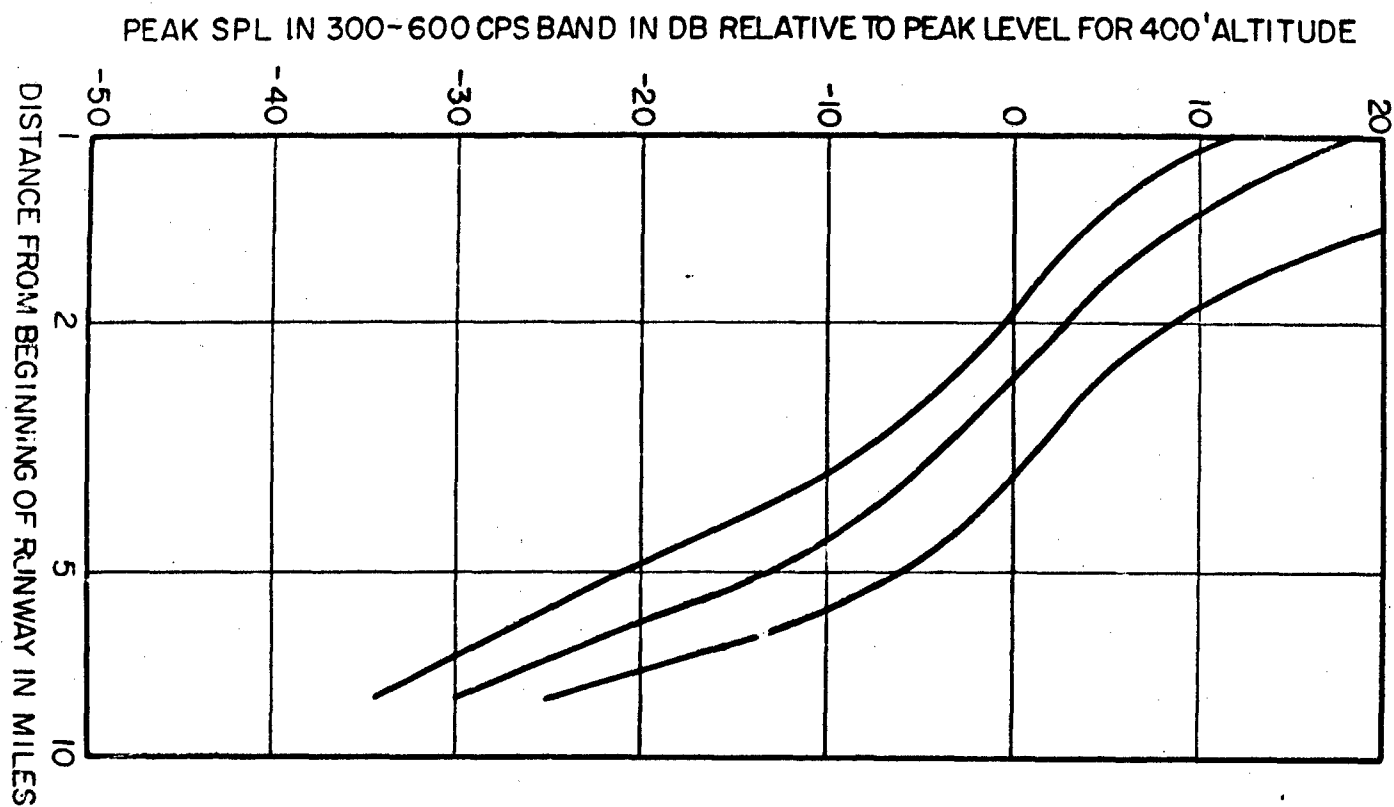


Figure 2. Estimates of Relative Sound Pressure Levels Directly Underneath Jet Aircraft Taking Off

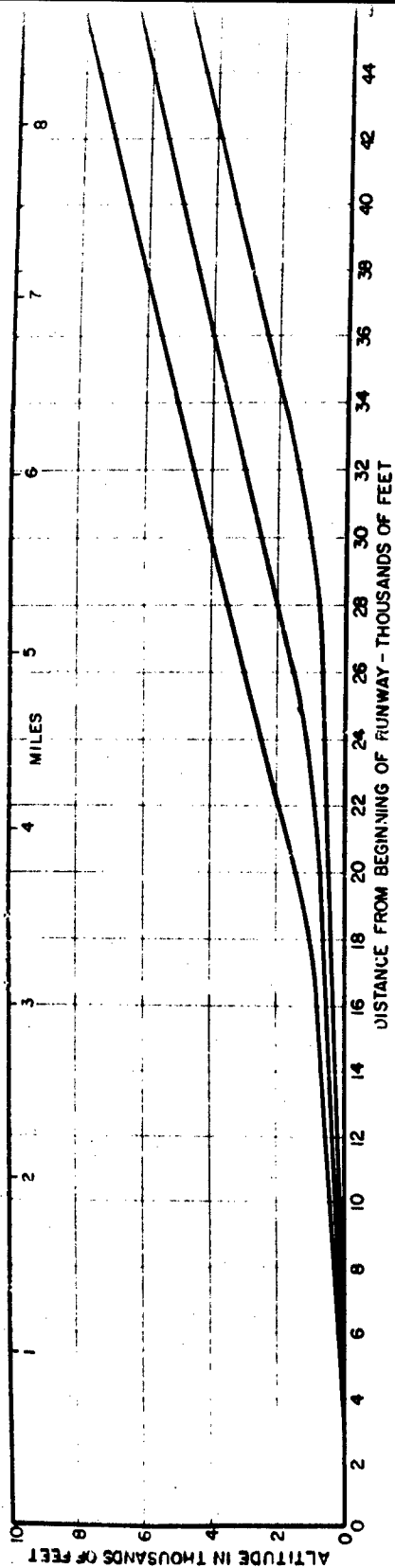


Figure 3. Estimates of Altitude Ranges for Jet Fighter and Light Bomber Take-Offs

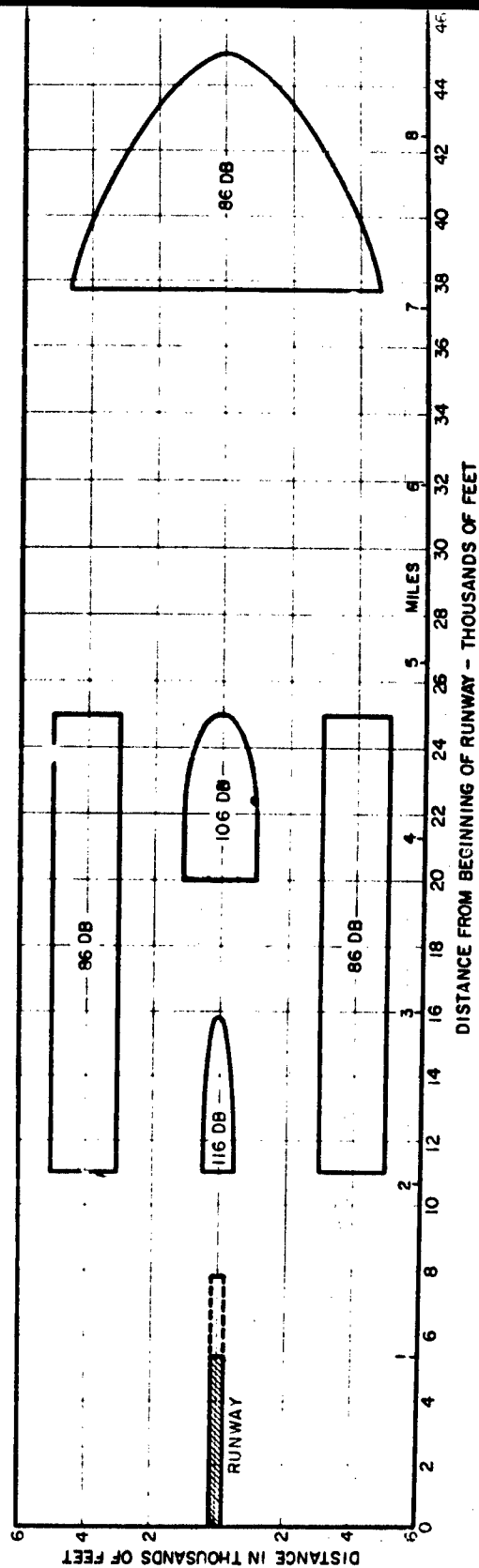


Figure 4. Proposed Sampling Areas, with Peak Levels in 300-600 cps Band for F-39C Aircraft

WADD TR 60-689(I)
National Opinion Research Center, University
of Chicago, Chicago, Illinois
COMMUNITY REACTIONS TO AIR FORCE
NOISE, Part 1. Basic Concepts and Preliminary
Methodology, by Paul N. Borsky
March 1961. 99 pp. incl. illus., and tables.
(Proj. 7210; Task 77444)
(Contr AF33(616)-2624) Unclassified report

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The broad theoretical framework is based on a
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York City and Hanscom Air Force Base residents,
and discussions with technical personnel

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the intervening sociopsychological variables
affecting individual perception, feelings
of annoyance, the additional interacting factors
modifying individual expression of such feelings
and the overall community considerations
determining the scope of community action. A
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also been developed and pretested for possible
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